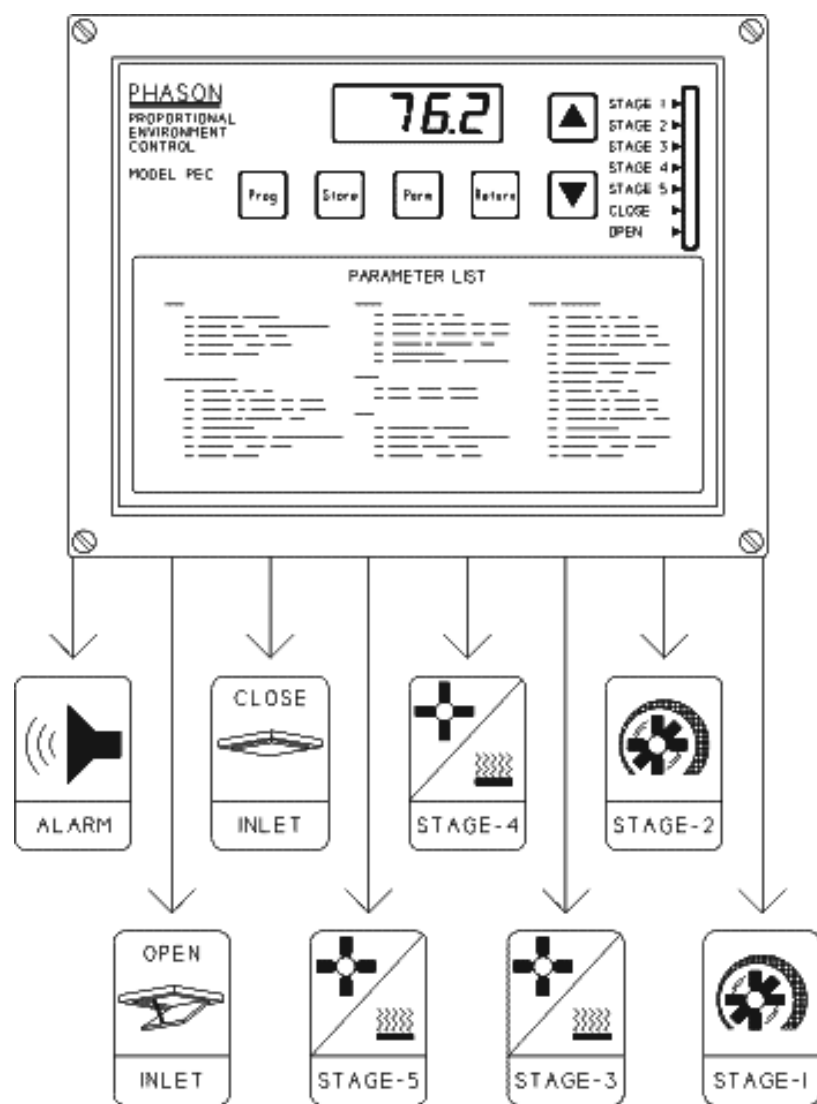


Proportional Environment Control

Model PEC user's guide



Limited warranty

This warranty applies only to the Phason Inc. (Phason) PEC. If you need warranty service, return the product and original proof of purchase to your dealer.

Phason warrants the PEC subject to the following terms and conditions.

This warranty is valid only to the original purchaser of the product, for two years from the manufacturing date. The manufacturing date is stated in the first eight digits of the serial number in the form year-month-day.

Phason hereby warrants that should this product fail because of improper workmanship, Phason will repair the unit, effecting all necessary parts replacements without charge for either parts or labor.

Conditions

- ◆ Installation must be done according to Phason's enclosed installation instructions.
- ◆ The product must not have been previously altered, modified, or repaired by anyone other than Phason.
- ◆ The product must not have been involved in an accident, misused, abused, or operated or installed contrary to the instructions in our user and/or installation manuals. Phason's opinion about these items is final.
- ◆ The person requesting warranty service must be the original purchaser of the unit, and provide proof of purchase upon request.
- ◆ All transportation charges for products submitted for warranty must be paid by the purchaser.

Except to the extent prohibited by applicable law, no other warranties, whether expressed or implied, including warranties of merchantability and fitness for a particular purpose, shall apply to this product. Any implied warranties are excluded.

Phason is not liable for consequential damages caused by this product.

Phason does not assume or authorize any representatives, or other people, to assume any obligations or liabilities, other than those specifically stated in this warranty.

Phason reserves the right to improve or alter the PEC without notice.

Service and technical assistance

Your dealer will be happy to answer all technical questions which will improve your use of the control. Be prepared with the model number, serial number and necessary information before you place a call to your dealer. If your control requires service when the warranty period has expired, return the unit to your dealer.

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Features of the PEC

The Proportional Environment Control (PEC), is a microprocessor based product designed to efficiently control the environment in livestock buildings. It has connections for two variable speed stages, three heat/cool stages, an inlet system and an alarm system. When operating, the PEC measures and displays the room temperature. While monitoring the temperature it controls the connected ventilation and heating equipment according to the programmed settings to keep the temperature at the desired point. The program settings can be adjusted in order to change the turn on points and other parameters of the stages. The following is a list of the standard features of the PEC.

- ◆ Two variable stage outputs
- ◆ Three relay stage outputs
- ◆ Two Inlet relay outputs
- ◆ One alarm relay output
- ◆ Four configurable operating programs
- ◆ Adjustable temperature set-point
- ◆ Adjustable temperature differential
- ◆ Adjustable high/low temperature alert settings
- ◆ Three-second full-power-turn-on to minimize fan ice-up
- ◆ Status LEDs
- ◆ Power-failure memory protection
- ◆ Four-digit LED display
- ◆ Fahrenheit and Celsius display
- ◆ Error code display for troubleshooting
- ◆ Thirty-foot temperature probe, extendable to 500 feet
- ◆ Overload protection fuses
- ◆ Rugged enclosure (corrosion resistant, water resistant, and fire retardant)
- ◆ CSA approval
- ◆ Two-year limited warranty

Getting started

Congratulations on the purchase of your new PEC environment control! This manual has been prepared to help you get the utmost in satisfaction from your PEC. It contains detailed information regarding the installation and operation of the control. The Getting Started section will step you through the installation and configuration of your PEC. The following steps refer to other sections of this user's guide for additional information. For this reason, it is not necessary to read through the entire document from front to back, but rather in the order that the information is needed.

STEP 1

Checking ratings of equipment

- ◆ Read the PEC electrical ratings on page 4.
- ◆ Fill in the Equipment list on page 5.

WARNING: The equipment to be connected to the PEC control must not draw more current than what the PEC stages are rated for. Use of equipment that is rated higher than the PEC will result in damage to the control and will void the warranty.

STEP 2

Installation

- ◆ Follow the instructions in Appendix A for installing and wiring the PEC and equipment. Be sure to read the General Warnings section in Appendix A before installation.

STEP 3

Testing

- ◆ Turn to Appendix B and follow the instructions there to test the operation of the equipment installed and to ensure that it is connected properly.

STEP 4**Setting up**

- ◆ Read through the Adjusting the PEC section starting on page 8 and get familiar with the programming procedures.
- ◆ Configure the PEC according to the type of equipment connected.
- ◆ Mark the changes in the Blank Program Tables in Appendix D.

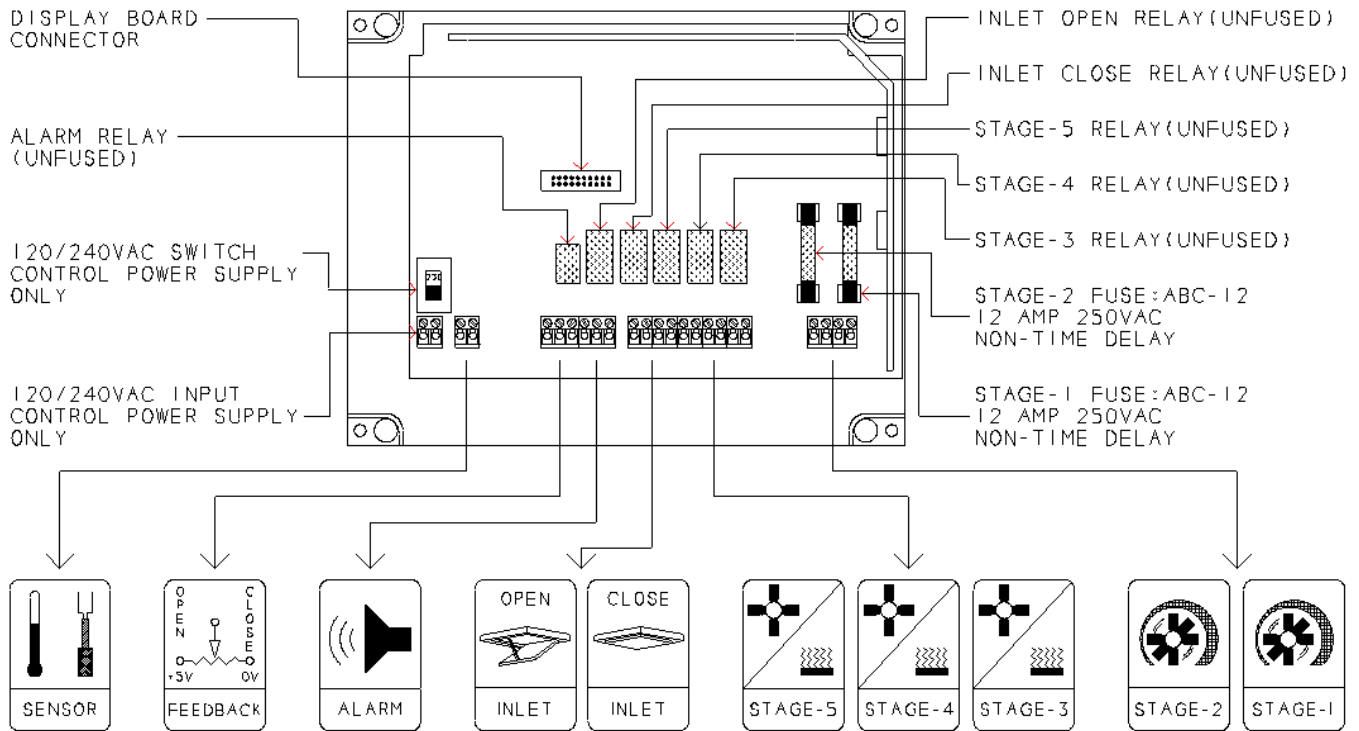
STEP 5**Putting control into service**

- ◆ Read the PEC operation section starting on page 14.
- ◆ Select the most useful factory program, on page 24.
- ◆ Make changes to the program as desired, on page 9.
- ◆ The INLETS section starting on page 26 describes how to calibrate the inlet and program the PEC to control the inlet automatically.
- ◆ Mark the changes in the Blank Program Tables in Appendix D.

STEP 6**Methods of use**

- ◆ Read the Methods of use section on page 29.

PEC electrical ratings



Temperature sensor: The standard temperature probe is 30 feet. Longer probes and extension cable are available.

Feedback: 5.0 VDC. The feedback potentiometer must be 1K to 20 K Ω .

Alarm relay: 0.4 A at 125 VAC, 2 A at 30 VDC, resistive load

0.2 A at 125 VAC; 1 A at 30 VDC, inductive load

Inlet relays: 4.4 A at 120 VAC, 2.2 A at 230 VAC, 5 A at 30 VDC

Relay stages 3, 4, and 5: 4.4 A at 120 VAC, 2.2 A at 230 VAC, general-purpose (resistive)

1/6 HP at 230 VAC

360 W tungsten at 120 VAC

Variable stages: 7.5 A at 120/230 VAC, general-purpose (resistive)

5 FLA 120/230 VAC, PSC motor

1/3 HP at 120 VAC, 1/2 HP at 230 VAC, PSC motor

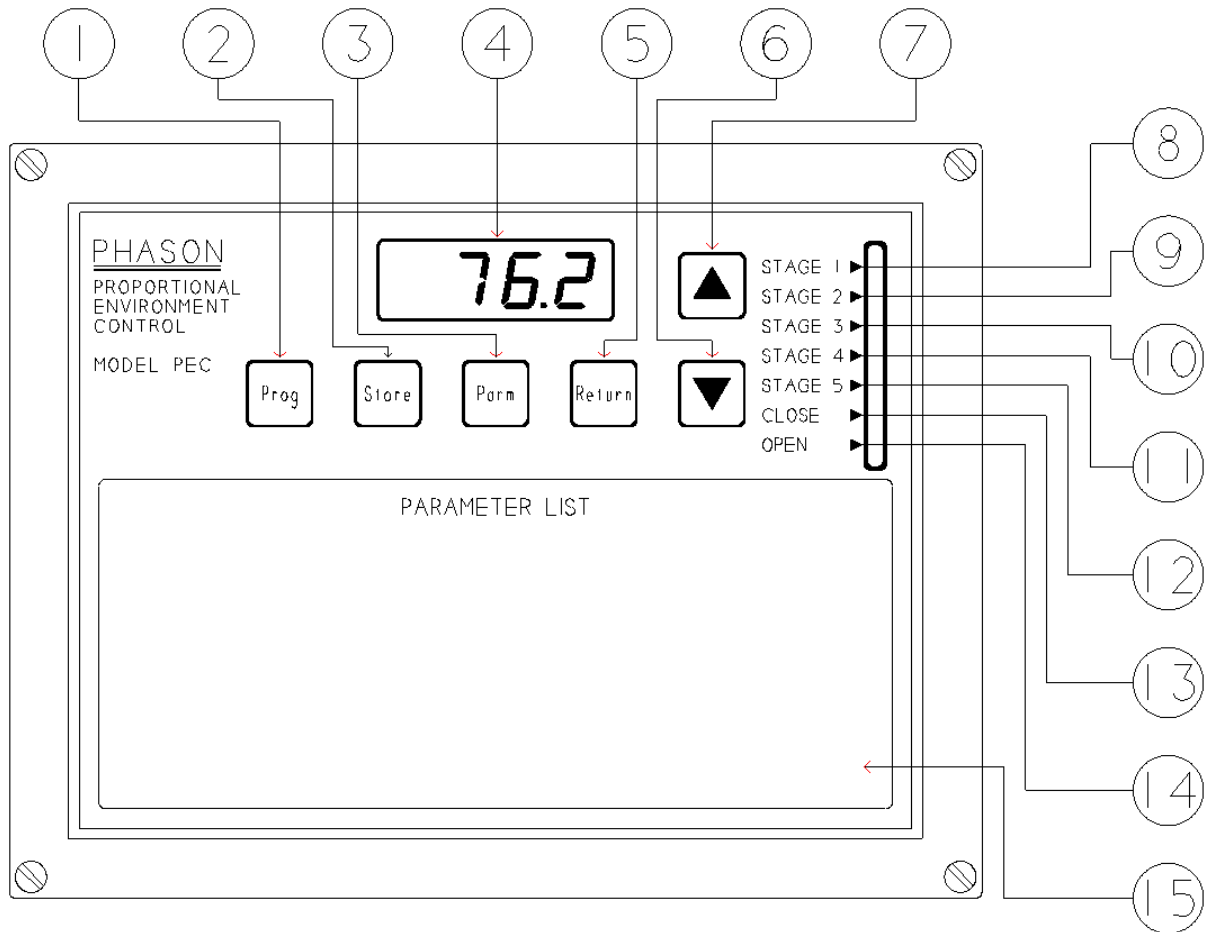
NOTE: This is not a wiring diagram. All wiring diagrams are located in Appendix A.

Equipment list

 STAGE-1	Variable speed stage 1	Make and model of fan(s): _____ Maximum total current draw of fan(s): _____ (must not be greater than 7.5 A) Operating voltage: _____
 STAGE-2	Variable speed stage 2	Make and model of fan(s): _____ Maximum total current draw of fan(s): _____ (must not be greater than 7.5 A) Operating voltage: _____
 STAGE-3	Cool/heat stage 3	Make and model of fan/heater: _____ Maximum total current draw: * _____ Operating voltage: _____
 STAGE-4	Cool/heat stage 4	Make and model of fan/heater: _____ Maximum total current draw: * _____ Operating voltage: _____
 STAGE-5	Cool/heat stage 5	Make and model of fan/heater: _____ Maximum total current draw: * _____ Operating voltage: _____
 INLET	Inlet stages	Make and model of actuator: _____ Maximum total current draw: * _____ Operating voltage: _____
 ALARM	Alarm	Alarm relay connected to: _____

* A power contactor must be used if the maximum total current draw is greater than the maximum ratings of the internal relay. See the electrical ratings section on page 4.

Getting to know the PEC



1 Program button
used to select the desired operating program

2 Store button
used to save selected programs and parameter settings in memory

3 Parameter button
used to scroll through the parameter list

4 Digital display
shows the temperature and settings

5 Return button
used to return back to normal operation

6 Down button
used to decrease the value of a parameter

7 Up button
used to increase the value of a parameter

8 Stage 1 indicator light

9 Stage 2 indicator light

10 Stage 3 indicator light

11 Stage 4 indicator light

12 Stage 5 indicator light

13 Close indicator light

14 Open indicator light

15 Complete parameter list

Definition of terms

Normal operation	The PEC is in normal operation when it is displaying room temperature. When alarms occur, the display will alternately flash the alarm signal and room temperature.
Programs	Programs consist of the Main, Differential, Inlet, Alarms and General parameters. The PEC has four programs which can be selected and reprogrammed by the user.
Operating program	The PEC operates according to the parameters in the operating program. Any one of the programs may be selected as the operating program.
Parameter list	The parameter list is printed on the front of the PEC and is also shown on page 22. It is a list of all the parameters that may be programmed by the user.
Parameters	Parameters are the individual settings which may be programmed. See the Parameter descriptions section on page 17 for an explanation for each of the parameters. There are six parameter categories. 1) Main - The MAIN parameters control the main operation of the control. 2) Differential - These parameters are programmable differentials. They are the number of degrees above or below the temperature set point the particular stage starts or turns on. 3) Inlet - The INLET parameters control the movement of the inlet. 4) Alarms - These parameters set the point at which the temperature alarms activate. 5) General - GENERAL parameters are common to all programs. These parameters have one setting which is used regardless of the operating program. 6) Setup - SETUP parameters control the overall operation of the unit. These parameters have only one setting which is used regardless of the operating program.

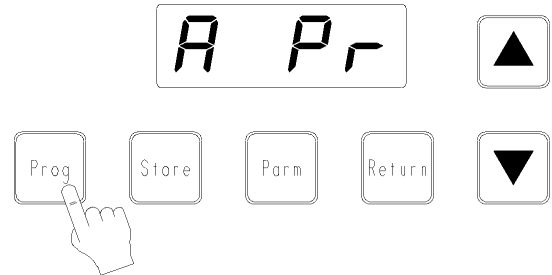
Adjusting the PEC

Selecting a new operating program

As livestock mature, often a change in the room climate is needed. The PEC has four different programs in memory for different climate settings. Any one of the programs can be the operating program. In order to change the operating program of the PEC, follow the instructions listed below. For a list of the factory settings in the programs see Table 3, on page 24.

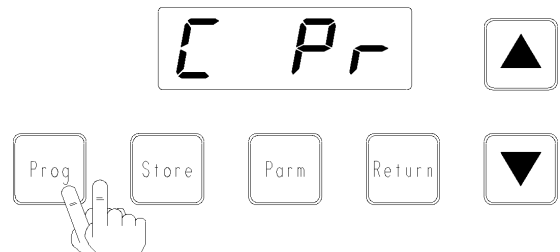
1. Press the **PROG** button once.

The PEC will display the current operating program, (**A**, **b**, **c**, or **d**). The display will flash the program name and **Pr**.



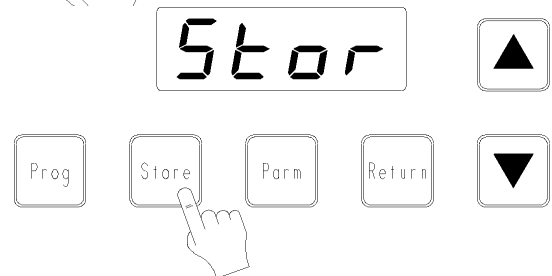
2. Press the **PROG** button a number of times until the desired program is displayed.

By pressing the **PROG** button, the program names are displayed one after another. To change to a different operating program, press the **PROG** button until the proper program is displayed.



3. Press the **STORE** button to enter the desired program into memory.

When the correct program is displayed, pressing the **STORE** button will tell the PEC to use the selected program as the operating program. After **Stor** is displayed, the PEC returns to normal operation.



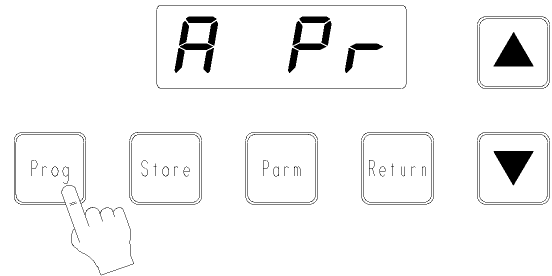
Changing parameter settings

Follow the steps below to view and/or edit the parameters in any program. After the parameters have been edited, the changes should be marked in the Blank Program Tables in Appendix D for future reference.

1. Press the **PROG** button until the program that you want to edit is displayed.

The display will flash the program letter, (**A** to **d**) and **Pr**.

NOTE: If the operating program is to be edited, step 1 may be skipped. The parameters of the operating program will be displayed by default.

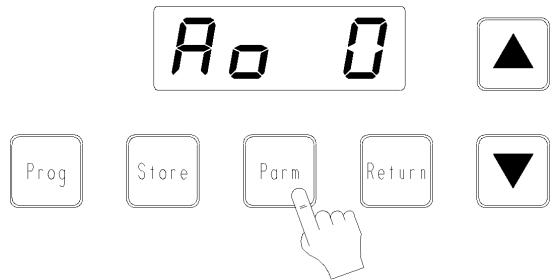


2. Press the **PARM** button once.

The first (left) digit shows the program that is being edited.

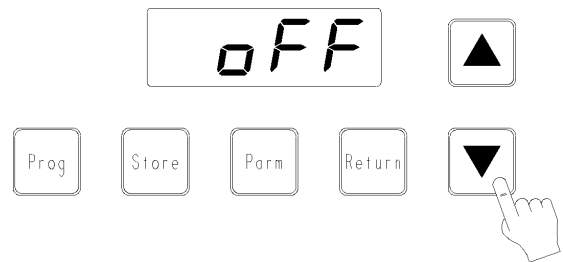
The second digit indicates if the program is the operating program. An **o** means the program is the operating program, a blank means it is not the operating program.

The two right-most digits represent the parameter number that is being edited.



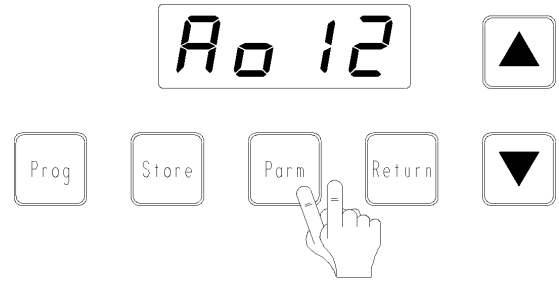
3. Press the **UP** or **DOWN** key to turn memory protect off.

The display will show **Ao 0** and then **oFF** indicating memory protect has been turned off. The parameters can now be adjusted. If memory protect is not turned off, the parameters can only be viewed. Attempting to adjust the parameters while memory protect is on will result in an **Err** message being displayed.



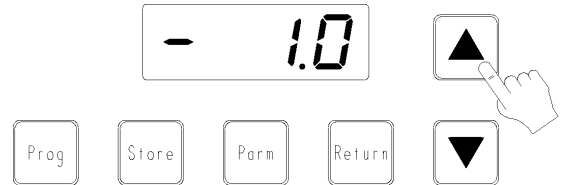
4. Press the **PARM** button to step through the parameter list until the desired parameter is reached.

Refer to the front cover of the PEC control or on page 22 and 23 for the parameter lists.



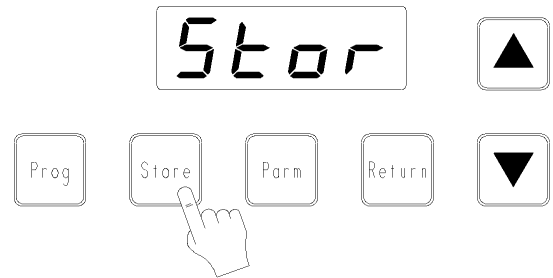
5. Use the **UP** or **DOWN** buttons to adjust the setting.

The parameter can be adjusted to any value within the parameter's range. The ranges are shown on page 22 and 23.



6. Press **STORE** to save the setting in memory.

The display will show **Stor** for 1 second indicating the new setting has been stored in memory. If the **PARM** button is pressed before pressing **STORE** the next parameter will appear and the previous one will change back to its previous setting.



Continue through the parameter list by pressing the **PARM** button and making changes to the settings where needed. Follow the same procedure shown in steps 4 to 6.

7. To return to normal operation (displaying of room temperature) at any time, press the **RETURN** button.

When **RETURN** is pressed, memory protect is automatically turned back on. If a parameter has been changed but the value has not been stored, pressing **RETURN** will change the parameter's setting to the last stored setting and then press **RETURN** again to return the control to normal operation.



NOTE: If the PEC is left displaying a parameter it will automatically revert back to normal operation in one minute. If **STORE** was not pressed the displayed parameter will change back to its previous value.

Setup (hidden) parameters

The setup parameters should be programmed when the installation has been completed to configure the PEC, and then generally the parameters do not need to be reprogrammed. When the setup parameters have been programmed, the blank program table in Appendix D should be filled in with the new settings for future reference. It is important that the Configuration sticker, included with the PEC, is marked correctly and affixed to the side of the PEC when the setup parameters have been programmed. The Configuration sticker provides a handy reference when you need to check the mode of operation of the staged outputs.

To edit the setup parameters

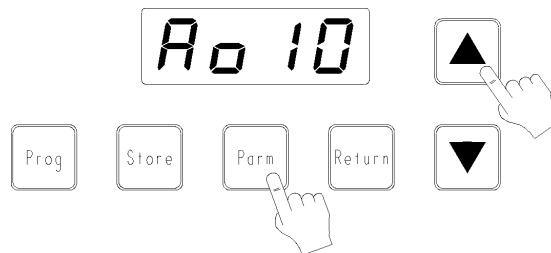
Press the **PARM** button once to enter the edit mode. If you wish to edit the setup parameters, you must turn off memory protect now. See page 9 to turn off the memory protection. Next press the **PROG** and **PARM** buttons simultaneously to access the setup parameters. The setup parameters can be adjusted as desired and stored in the same way the normal parameters can. After the setup parameters have been changed and stored, press the **RETURN** button to return to normal operation.



Programming tips

Scrolling backwards

When viewing or editing the parameters, sometimes it is helpful to scroll backwards through the parameter list. To do this, press the **PARM** and **UP** buttons simultaneously. Instead of the PEC displaying the next parameter on the list, it will display the previous parameter.



Selecting a parameter to edit

The parameters are stored in a table in memory which is similar to the Factory Program Table on page 24. Any parameter in any program can be edited when memory protection has been turned off. Follow these procedures when editing parameters to become more efficient.

- ◆ To move down to the next parameter press the **PARM** button.
- ◆ To move up or backwards to the previous parameter press the **PARM** and **UP** buttons simultaneously.
- ◆ To move right press the **PROG** button until the desired program is displayed, then press the **PARM** button once to edit the same parameter number that was being edited before.

To move Press button(s)

↑ **PARM**

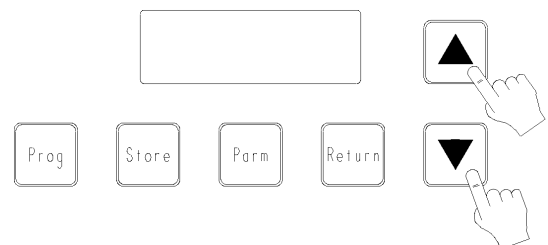
↓ **PARM** and **UP**

→ **PROG**

An example where this method of programming is useful would be a situation where the temperature set point of each program needs to be changed. This could be done by turning off memory protection and changing the temperature set point in the operating program, (the operating program is displayed with an o and the program name). Then press the **PROG** button two times to edit the next program. Press the **PARM** button and edit the parameter. To continue to the next program press the **PROG** button again. Remember that **STORE** must be pressed after each change to save the new setting in memory.

Fast editing

When editing the setting of a parameter by adjusting it up or down, hold down either button and then press the other one. This will change the setting ten times faster. If you want to increase the setting, hold down the **UP** button and then press the **DOWN** button. The setting will increase ten times faster. To decrease the setting ten times faster, hold down the **DOWN** button and then press the **UP** button.



Reloading the factory programs

The factory programs can be reloaded if so desired, to replace the existing programs. If the existing programs are not operating properly or need to be changed back to the original factory programs, follow the steps below to reload the factory programs.



When the factory programs are reloaded, both of the existing programs including the setup parameters will be replaced. The PEC will begin with program A as the operating program. The programs and most importantly the setup parameters will need to be reprogrammed for the equipment that is connected. Pay close attention to the Setup parameters for Stages 3, 4 and 5.

1. Turn off the power to the PEC.
2. Hold down the **PROG** and **STORE** buttons.
3. While holding the buttons down, turn the power back on. The display will flash **Stor** for two seconds and then the PEC will be in the normal operating mode and displaying the room temperature.



PEC operation

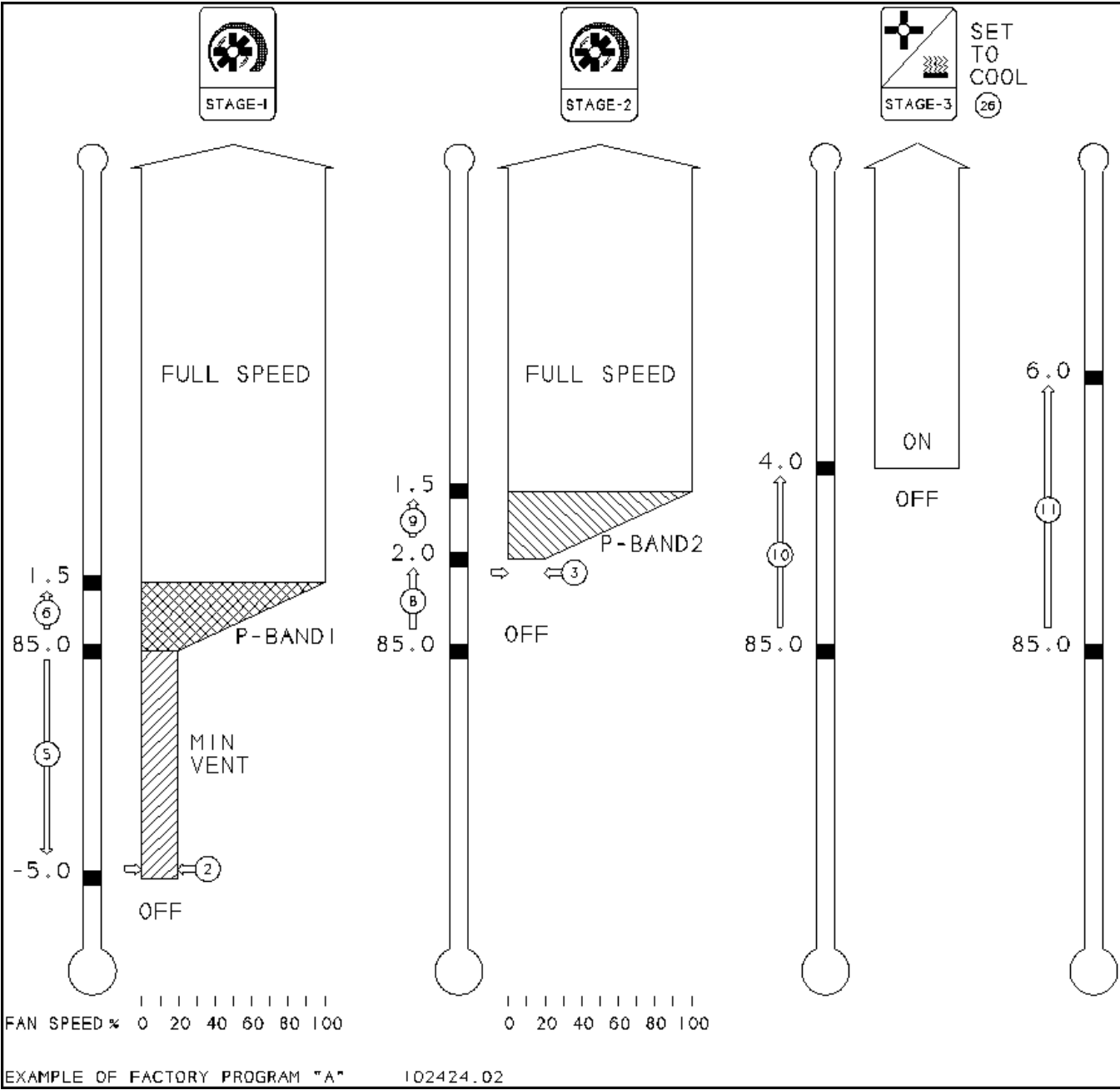


Figure 2: PEC operation diagram—circled numbers correspond to the parameter numbers.

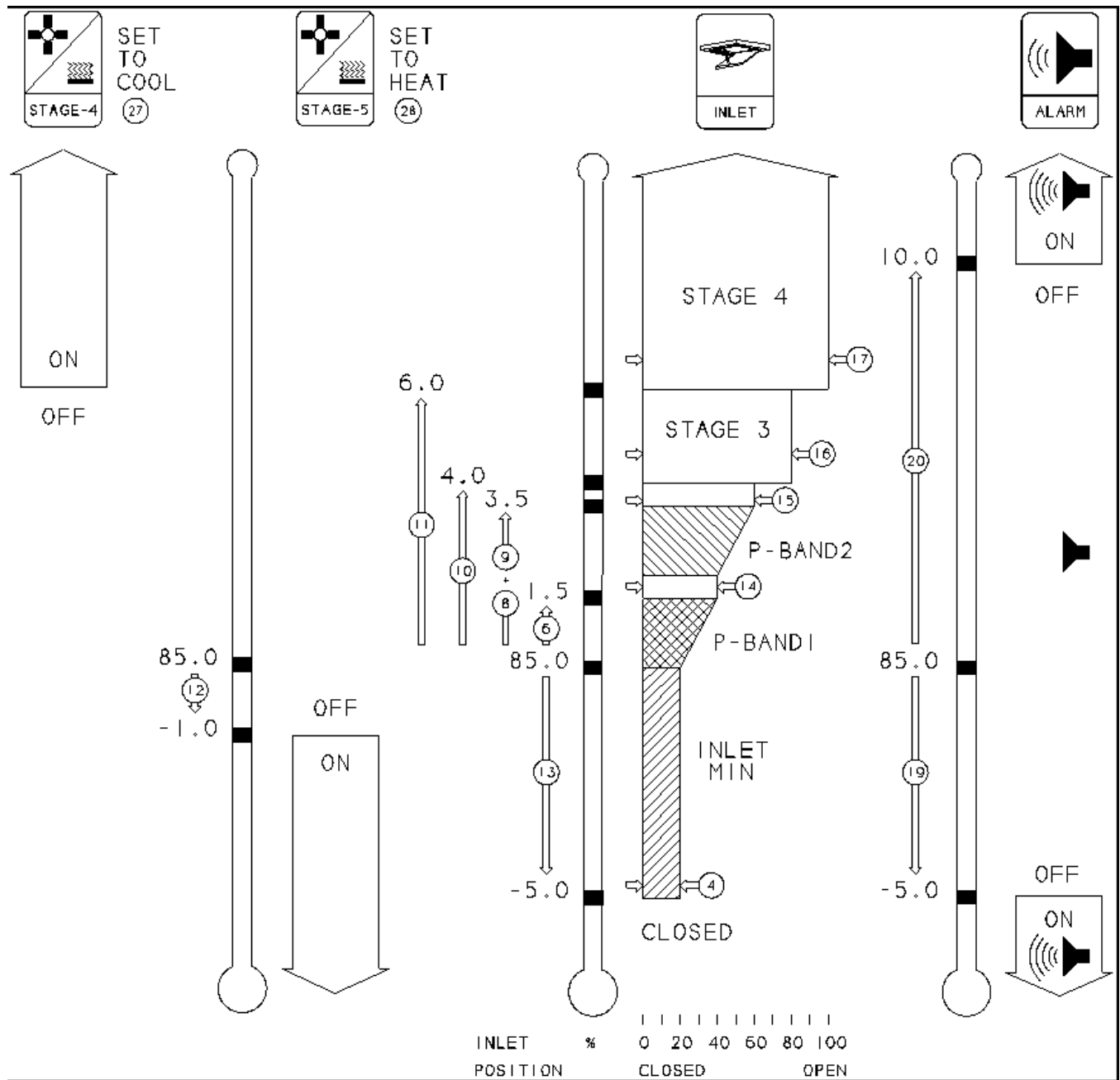


Figure 2 on page 14 shows the operation of each stage of the PEC. This particular diagram shows when the stages will turn on and off when the PEC is operating according to the factory settings in program A. Some settings are listed here but the entire factory program table can be found on page 24. The circled numbers correspond to the parameter numbers. Use these numbers to cross reference the parameters in the diagram to their descriptions. All stages have a programmable hysteresis, parameter 34.

Parameter settings		
1	Temp Set (Start P-Band1)	85.0°F
2	Stage 1 Min Vent	20%
3	Stage 2 Min Vent	20%
4	Inlet Min	20%
5	Stage 1 OSB	-5.0
6	Stage 1 P-Band1	1.5
7	Stage 2 OSB	0.0
8	Stage 2 Start P-Band2	2.0
9	Stage 2 P-Band2	1.5
10	Stage 3 Turn On	4.0
11	Stage 4 Turn On	6.0
12	Stage 5 Turn On	-1.0
13	Inlet Close-Set-Back	-5.0
14	Position P-Band 1	40%
15	Position P-Band 2	60%
16	Position Stage 3	80%
17	Position Stage 4	99%
18	Position Stage 5	99%
19	Low Temp Alarm	-5.0
20	High Temp Alarm	10.0

NOTE: When the variable speed stages turn on, they will run full speed for three seconds and then decrease to the required speed.

Example

As an example, say the temperature is 75°F and rising. At this point Stage 5 (heat) and the Low Temp Alarm will be on. The Position Stage 5 parameter will not affect the inlet because Stage 5 is set for heating operation. When the temperature rises to 80°F, the Low Temp Alarm will turn off, the Stage 1 fan will turn on and the inlet will open to its minimum setting. The Stage 1 fan will run at full speed for three seconds and then slow down to the Minimum Ventilation setting.

When the temperature reaches 84°F Stage 5 (heat) will turn off. At 85°F the Stage 1 P-Band starts. While the temperature rises in the P-Band, the Stage 1 fan will increase in speed and the inlet will open proportionally to the temperature. At 86.5°F Stage 1 will be at full speed and the inlet will be open to the Position P-Band 1 setting.

When the temperature rises to 87°F the Stage 2 P-Band starts. Since the Stage 2 fan has been off until now, it will run full speed for three seconds and then slow down to the required speed. As the temperature rises in the Stage 2 P-Band, the Stage 2 fan will increase in speed and the inlet will open proportionally to the temperature. At 88.5°F the Stage 2 fan will be at full speed and the inlet will be open to the Position P-Band 2 setting.

At 89°F Stage 3 (cool) will turn on and the inlet will open to the Position Stage 3 setting.

At 91°F Stage 4 (cool) will turn on and the inlet will open to the Position Stage 4 setting.

When the temperature rises to 95°F the High Temperature Alarm turns on.

Parameter descriptions

Main parameters

- 0 MEMORY PROTECT [On/Off] - ensures parameters are not changed by accident. Memory protect must be turned off every time the parameters are edited. The memory protect parameter can not be stored and is turned on automatically when the control returns to normal operation.
- 1 TEMPERATURE SET (Start P-Band 1) [32.0 - 110.0°F, 0.0 - 43.3°C] - is the target room temperature. The differentials and alarms are referenced to this setting. It is the starting point of the Stage 1 P-Band (parameter #6).
- 2 STAGE 1 MINIMUM VENTILATION [Minimum Idle (#21) - 99] - is the idle speed in percent of full power at which the Stage 1 fan will idle at. It cannot be adjusted below the setting of the Minimum Idle (#32) parameter.
- 3 STAGE 2 MINIMUM VENTILATION [Minimum Idle (#22) - 99] - is the idle speed in percent of full power at which the Stage 2 fan will idle at. It cannot be adjusted below the setting of the Minimum Idle (#33) parameter.
- 4 INLET MINIMUM [0 - 99] - is the percentage of opening the inlet will open to when the temperature is in the inlet close-set-back region.

Differentials

- 5 STAGE 1 OFF-SET-BACK [IDLE, -20.0 - 0.0°F, -11.1 - 0.0°C] - is a range of degrees below the Temp Set where the Stage 1 fan will be at idle speed, and below this range the fan will be off. Idle means the fan will run at the Min Vent setting at all temperatures below the Temp Set. If Temp Set (#1) is set to 80°F and Stage 1 Off-Set-Back (#5) is set at -8°F the fan will idle when the temperature is between 72°F and 80°F, but will be off below 72°F.
- 6 STAGE 1 P-BAND1 [0.0 - 16.0°F, 0.0 - 8.9°C] - The proportional band is a range of degrees above the Temp Set where the Stage 1 fan increases in speed proportionally to the temperature. If Temp Set (#1), is set to 80°F and Stage 1 P-Band1 (#6) is set at 5°F the variable speed fan will start to increase speed at 80°F and will be at full speed at 85°F .
- 7 STAGE 2 OFF-SET-BACK [IDLE, -20.0 - 0.0°F, -11.1 - 0.0°C] - is a range of degrees below the Stage 2 Start P-Band2 (#8) where the Stage 2 fan will be at idle speed, and below this range the fan will be off. Idle means the fan will run at the Min Vent setting at all temperatures below the Stage 2 Start P-Band2 (#8) setting. If Temp Set (#1) is set to 80°F, Start of P-Band Stage 2 (#8) is set to 10°F and Stage 2 Off-Set-Back (#7) is set at -3°F, the Stage 2 fan will idle between 87°F and 90°F but will be off below 87°F.
- 8 STAGE 2 START P-BAND2 [-10.0 - 15.0°F, -5.5 - 8.4°C, OFF] - is the number of degrees above or below the Temp Set at which the Stage 2 proportional band starts. All Stage 2 differentials are with respect to this setting. If the Temp Set (#1) is 80°F and this parameter (#8) is set to 10°F , the Stage 2 P-Band will start at 90°F .

- 9 STAGE 2 P-BAND2 [0.0 - 16.0°F, 0.0 - 8.9°C] - The proportional band is a range of degrees above Stage 2 Start P-Band2 where the Stage 2 fan will increase in speed proportionally to the temperature. If Temp Set (#1) is set to 80°F, Stage 2 Start P-Band2 (#8) is set to 10°F and Stage 2 P-Band2 (#9) is set at 5°F, the Stage 2 variable speed fan will start to increase speed at 90°F and will be at full speed at 95°F.
- 10 STAGE 3 TURN ON [-10.0 - 15.0°F, -5.5 - 8.4°C, OFF] - is the number of degrees above or below the Temp Set at which Stage 3 will turn on. If the Temp Set (#1) is set to 80°F and Stage 3 Turn On (#10) is set to 5°F, Stage 3 will turn on at 85°F. The Stage 3 Operation (#26) parameter regulates what mode Stage 3 operates in, heat or cool.
- 11 STAGE 4 TURN ON [-10.0 - 15.0°F, -5.5 - 8.4°C, OFF] - is the number of degrees above or below the Temp Set at which Stage 4 will turn on. If the Temp Set (#1) is set to 80°F and Stage 4 Turn On (#11) is set to 10°F, Stage 4 will turn on at 90°F. The Stage 4 Operation (#27) parameter regulates what mode Stage 4 operates in, heat or cool.
- 12 STAGE 5 TURN ON [-10.0 - 15.0°F, -5.5 - 8.4°C, OFF] - is the number of degrees above or below the Temp Set at which Stage 5 will turn on. If the Temp Set (#1) is set to 80°F and Stage 5 Turn On (#12) is set to -5°F, Stage 5 will turn on at 75°F. The Stage 5 Operation (#28) parameter regulates what mode Stage 5 operates in, heat or cool. Stage 5 will operate as a proportional interval timer if Proportional (#29) is set to ON.

Inlet parameters

- 13 INLET CLOSE-SET-BACK [IDLE, -20.0 - 0.0°F, -11.1 - 0.0°C] - is a range of degrees below the Temp Set where the inlet will be open to it's minimum setting (#4), and below this range the inlet will be closed. When this parameter is programmed to IDLE, the inlet will be open at the minimum position at all temperatures below the Temp Set. If Temp Set (#1) is set to 80°F and Inlet Close-Set-Back (#13) is set at -8°F the inlet will be at the minimum position when the temperature is between 72°F and 80°F, but will be closed below 72°F.
- 14 POSITION P-BAND 1 [0 - 99] - is the amount of opening in percent that the inlet will open to when the temperature is at the upper end of the stage 1 proportional band. The inlet will open proportionally through out the Stage 1 P-Band1 (#6).
- 15 POSITION P-BAND 2 [0 - 99] - is the amount of opening in percent that the inlet will open to when the temperature is at the upper end of the stage 2 proportional band. The inlet will open proportionally through out the Stage 2 P-Band2 (#9).
- 16 POSITION STAGE 3 [0 - 99] - is the amount of opening in percent that the inlet will open to when Stage 3 turns on (#10). This will only occur if stage 3 is set for cooling mode. If stage 3 is set for heating mode, the inlet will not be affected when stage 3 turns on.
- 17 POSITION STAGE 4 [0 - 99] - is the amount of opening in percent that the inlet will open to when Stage 4 turns on (#11). This will only occur if stage 4 is set for cooling mode. If stage 4 is set for heating mode, the inlet will not be affected when stage 4 turns on.

- 18 POSITION STAGE 5 [0 - 99] - is the amount of opening in percent that the inlet will open to when Stage 5 turns on (#12). This will only occur if stage 5 is set for cooling mode. If stage 5 is set for heating mode, the inlet will not be affected when stage 5 turns on.

Alarms

- 19 LOW TEMPERATURE ALARM [OFF, -36.0 - 0.0°F, -20.0 - 0.0°C] - is the number of degrees below the Temp Set that a low temperature alarm will be generated, (**A L~~E~~**). This alarm may be disabled by adjusting it to OFF.
- 20 HIGH TEMPERATURE ALARM [0.0 - 36.0°F, 0.0 - 20.0°C, OFF] - is the number of degrees above the Temp Set that a high temperature alarm will be generated, (**A h~~E~~**). This alarm may be disabled by adjusting it to OFF.

General parameters

General parameters have one setting common to all programs. This setting is in effect regardless of the operating program.

- 21 LOW POWER ALARM [ON - OFF] - When the line voltage drops below the proper operating level, a low power alarm will be displayed (**A LP**). This alarm may be disabled by adjusting it to OFF. When disabled, the display will still flash **A LP**, but the alarm relay will not activate.
- 22 INLET ALARMS [ON - OFF] - When this parameter is ON, all inlet alarms will flash on the display and the alarm relay will be activated. The alarms are Jam Open - **A Jo**, Jam Close - **A Jc**, and Feedback alarm - **A Fb**. The jam open and jam close alarms appear when the PEC is trying to move the inlet but does not receive the correct message back from the inlet. This can happen if the feedback wires are connected backwards, or if the inlet has not been calibrated or is mechanically stuck. The feedback alarm appears when the feedback wires have been damaged, shorted or disconnected. When this parameter is off, the alarm messages will not be displayed and the alarm will not activate if these conditions occur. Press **RETURN** to clear a jam alarm and retry the positioning of the inlet.
- 23 ALARM LATCHING [ON - OFF] - When this parameter is turned ON, all alarms will be displayed on the PEC and will continue to flash after the alarm condition is gone. They can be reset by pressing the RETURN button. This feature is useful to keep track of the alarms that occur during times when the control is not being supervised. For example; in the morning the PEC could be checked for alarms that occurred during the night and then the alarms could be cleared. If this parameter is turned OFF, the display will only show the alarm when the condition is present. When the alarm condition is gone, the alarm will no longer be displayed. NOTE: Only the alarm display will latch and not the alarm relay.
- 24 VENTILATION [ON - OFF] - When this parameter is turned OFF, the variable speed outputs and cooling stages are turned off completely and all alarms will not be displayed. The heating stages are not affected. Ventilation may be turned OFF when a room is vacant to conserve energy. When it is turned OFF the PEC will display **uOFF**. DO NOT use this to shut down fans to work on the wiring. Ensure the breakers are turned off.

Setup (HIDDEN) Parameters

The setup (hidden) parameters are common to all programs and can only have one setting. They are called hidden because they can not be accessed in the same area as the normal parameters. This has been done to protect these parameters from accidentally being changed. Follow the instructions on page 11 to program these parameters.

- 25 TEMPERATURE UNITS [°F - °C] - This parameter programs the PEC to display temperature in degrees Fahrenheit or degrees Celsius.
- 26 STAGE 3 OPERATION [HEAT - COOL] - This parameter programs the Stage 3 output to operate as a heating stage or a cooling stage. When it is set to HEAT, the stage will be on below the Stage 3 Turn On (#10). If it is set to COOL, the stage will be on above the Stage 3 Turn On (#10).
- 27 STAGE 4 OPERATION [HEAT - COOL] - This parameter programs the Stage 4 output to operate as a heating stage or a cooling stage. When it is set to HEAT, the stage will be on below the Stage 4 Turn On (#11). If it is set to COOL, the stage will be on above the Stage 4 Turn On (#11).
- 28 STAGE 5 OPERATION [HEAT - COOL] - This parameter programs the Stage 5 output to operate as a heating stage or a cooling stage. When it is set to HEAT, the stage will be on below the Stage 5 Turn On (#12). If it is set to COOL, the stage will be on above the Stage 5 Turn On (#12).
- 29 STAGE 5 PROPORTIONAL [ON - OFF] - When this parameter is turned on, stage 5 will be in the proportional interval mode.
- 30 STAGE 5 INTERVAL [5 - 25] - This parameter sets the length of the proportional interval in minutes. When Stage 5 Proportional (#29) is set to off, this parameter does not affect the operation of the PEC in any way.
- 31 STAGE 5 P-BAND [0.0 - 16.0°F, 0.0 - 8.9°C] - This is the proportional band of the interval timer. It is a range of degrees above or below the Stage 5 Turn On (#12) point where stage 5 will operate proportional to the temperature. When the temperature exceeds the P-Band range, stage 5 will be on continuously.
- 32 STAGE 1 MINIMUM IDLE [0 - 99] - This is the minimum idle preset in percent of full speed. The Min Vent (#2) can not be adjusted below the setting of this parameter. For example; if it is programmed to 20 the Stage 1 Min Vent (#2) parameter can not be adjusted below 20. It is recommended that this parameter be programmed to correspond to the lowest speed at which the motor can still operate.
- 33 STAGE 2 MINIMUM IDLE [0 - 99] - This is the minimum idle preset in percent of full speed. The Min Vent (#3) can not be adjusted below the setting of this parameter. For example; if it is programmed to 20 the Stage 2 Min Vent (#3) parameter can not be adjusted below 20. It is recommended that this parameter be programmed to correspond to the lowest speed at which the motor can still operate.

- 34 HYSTERESIS [0.5 - 2.5°F, 0.3 - 1.4°C] - This is the number of degrees of difference between the turn-on point and turn-off point for all stages. It is the number of degrees above the turn-on point that a heating stage will turn off, and the number of degrees below the turn-on point that a cooling stage will turn off.

- 35 STAGE 1 POWER FACTOR COMPENSATION [5 - 25] - This is set at the factory to 10 and should only be adjusted if the Stage 1 variable speed fan does not operate properly with the PEC.

- 36 STAGE 2 POWER FACTOR COMPENSATION [5 - 25] - This is set at the factory to 10 and should only be adjusted if the Stage 2 variable speed fan does not operate properly with the PEC.

- 37 INLET MANUAL OPERATION [ON - OFF] - When this parameter is turned off, the PEC controls the inlet automatically according to the temperature and the position setting for each stage. When this parameter is set to ON the inlet can be manually positioned by pressing the UP or DOWN button. Press UP to OPEN the inlet and DOWN to CLOSE the inlet. The inlet will stay in the same position regardless of any changes in the temperature.

- 38 INLET HYSTERESIS [0 - 10] - This parameter adjusts the accuracy of the inlet. The hysteresis is the tolerance in percent that the inlet can be resting away from the desired position. This parameter must be adjusted to suit the characteristics of the particular inlet control system. If the Inlet Hysteresis is too small, the inlet will oscillate around the desired position and will not sit at a steady position. If the Inlet Hysteresis is set too large, the inlet will not be positioned with accuracy according to the position settings.

- 39 INLET TIME OUT [5 - 60] - The Inlet Time Out is the total length of time in seconds that the PEC will wait for the inlet to move. If the inlet does not move the amount required within the time out period, the inlet will stop moving and a jam alarm will be displayed if Inlet Alarms (#22) is turned on.

- 40 INLET CALIBRATION [ON - OFF] - When this parameter is turned on it starts the calibration process. During calibration, the inlet is closed, then opened completely and then closed completely. This will program the minimum and maximum ranges for the particular inlet system. When the calibration is complete the parameter will turn off automatically. The calibration must be done in order for the PEC to control the inlets in automatic mode.

Parameter ranges

#	Parameters	Ranges	
		°F	°C
	Main		
0	Memory Protect	ON / OFF	
1	Temp Set (Start P-Band1)	32.0 - 110.0	0.0 - 43.3
2	Stage 1 Min Vent	Min Idle (parm #32) - 99	
3	Stage 2 Min Vent	Min Idle (parm #33) - 99	
4	Inlet Min	0 - 99	
	Differential		
5	Stage 1 Off-Set-Back	IDLE, -20.0 - 0.0	IDLE, -11.1 - 0.0
6	Stage 1 P-Band1	0.0 - 16.0	0.0 - 8.9
7	Stage 2 Off-Set-Back	IDLE, -20.0 - 0.0	IDLE, -11.1 - 0.0
8	Stage 2 Start P-Band2	-10.0 - 15.0, OFF	-5.5 - 8.4, OFF
9	Stage 2 P-Band2	0.0 - 16.0	0.0 - 8.9
10	Stage 3 Turn On	-10.0 - 15.0, OFF	-5.5 - 8.4, OFF
11	Stage 4 Turn On	-10.0 - 15.0, OFF	-5.5 - 8.4, OFF
12	Stage 5 Turn On	-10.0 - 15.0, OFF	-5.5 - 8.4, OFF
	Inlet		
13	Inlet Close-Set-Back	IDLE, -20.0 - 0.0	IDLE, -11.1 - 0.0
14	Position P-Band 1	0 - 99	
15	Position P-Band 2	0 - 99	
16	Position Stage 3	0 - 99	
17	Position Stage 4	0 - 99	
18	Position Stage 5	0 - 99	
	Alarms		
19	Low Temp Alarm	OFF, -36.0 - 0.0	OFF, -20.0 - 0.0
20	High Temp Alarm	0.0 - 36.0, OFF	0.0 - 20.0, OFF
	General (common to all programs)		
21	Low Power Alarm	ON / OFF	
22	Inlet Alarms	ON / OFF	
23	Alarm Latching	ON / OFF	
24	Ventilation	ON / OFF	

Table 1: Parameter ranges

Setup (hidden) parameter ranges

#	SETUP (Hidden) parameters common to all programs	Range
25	Temperature Units	F / C
26	Stage 3 Operation	HEAT / COOL
27	Stage 4 Operation	HEAT / COOL
28	Stage 5 Operation	HEAT / COOL
29	Stage 5 Proportional	ON / OFF
30	Stage 5 Interval	5 - 25
31	Stage 5 P-Band	0.0 - 16.0°F 0.0 - 8.9°C
32	Stage 1 Minimum Idle	0 - 99
33	Stage 2 Minimum Idle	0 - 99
34	Hysteresis	0.5 - 2.5°F 0.3 - 1.4°C
35	Stage 1 P.F. Compensation	5 - 25
36	Stage 2 P.F. Compensation	5 - 25
37	Inlet Manual Operation	ON / OFF
38	Inlet Hysteresis	0 - 10
39	Inlet Time Out	5 - 60
40	Inlet Calibration	ON / OFF

Table 2: Setup parameter ranges

Factory programs

The PEC is programmed at the factory with the settings shown below. See the GETTING TO KNOW THE PEC section for instructions for selecting a program. Select the most useful program and make changes where necessary.

#	Parameters	Program names			
		<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>
	Main				
1	Temp Set (Start P-Band1)	85.0	80.0	75.0	70.0
2	Stage 1 Min Vent	20	20	30	30
3	Stage 2 Min Vent	20	20	30	30
4	Inlet Min	20	20	30	30
	Differential				
5	Stage 1 Off-Set-Back	-5.0	-5.0	-5.0	-5.0
6	Stage 1 P-Band1	1.5	2.0	2.0	3.0
7	Stage 2 Off-Set-Back	0.0	0.0	0.0	0.0
8	Stage 2 Start P-Band2	2.0	2.0	2.5	3.0
9	Stage 2 P-Band2	1.5	2.0	2.0	3.0
10	Stage 3 Turn On	4.0	5.0	5.0	7.0
11	Stage 4 Turn On	6.0	7.0	7.0	9.0
12	Stage 5 Turn On	-1.0	-1.0	-1.0	-1.0
	Inlet				
13	Inlet Close-Set-Back	-5.0	-5.0	-5.0	-5.0
14	Position P-Band 1	40	40	40	40
15	Position P-Band 2	60	60	60	60
16	Position Stage 3	80	80	80	80
17	Position Stage 4	99	99	99	99
18	Position Stage 5	99	99	99	99
	Alarms				
19	Low Temp Alarm	-5.0	-5.0	-5.0	-5.0
20	High Temp Alarm	10.0	10.0	15.0	15.0
	General (common to all programs)				
21	Low Power Alarm	ON			
22	Inlet Alarms	ON			
23	Alarm Latching	ON			
24	Ventilation	ON			

Table 3: Factory programmed parameter list (All temperatures in °F)

Setup (hidden) parameter table

#	Setup (hidden) parameters common to all programs	Factory setting
25	Temperature Units	F
26	Stage 3 Operation	Cool
27	Stage 4 Operation	Cool
28	Stage 5 Operation	Heat
29	Stage 5 Proportional	OFF
30	Stage 5 Interval	10
31	Stage 5 P-Band	2
32	Stage 1 Minimum Idle	20
33	Stage 2 Minimum Idle	20
34	Hysteresis	0.5
35	Stage 1 P.F. Compensation	10
36	Stage 2 P.F. Compensation	10
37	Inlet Manual Operation	ON
38	Inlet Hysteresis	2
39	Inlet Time Out	10
40	Inlet Calibration	OFF

Table 4: Setup parameter factory settings

Inlets

Inlets can be controlled automatically or manually by the PEC. The type of operation is selected by changing the setting of the parameter Inlet Manual Operation (parameter # 37). When the Inlet Manual Operation parameter is set to OFF the inlets will be controlled automatically.

Manual operation

In manual operation, the inlets can be positioned by pressing the **UP** and **DOWN** buttons while in normal operation. Pressing the **UP** button will open the inlets. The display will flash **oPEn** and the current position in percent of the maximum opening. Pressing the **DOWN** button will close the inlets. The display will flash **cLoS** and the current position in percent of the maximum opening. When the inlet is adjusted to the desired position it will not move regardless of the temperature until the **UP** or **DOWN** buttons are pressed again.

Automatic operation

In automatic operation, the PEC will position the inlets automatically according to the room temperature. In general, as the variable speed fans speed up and cooling stages turn on the inlets will be opened, but as the temperature decreases and the fans slow down and cooling stages turn off the inlets will be closed. Adjust the Inlet Hysteresis (parameter #38) and Inlet Time Out (parameter #39) to fine tune the operation of the inlets. Adjust the position settings (parameters #14 - 18) to set the position of the inlets for each stage p-band or turn on. The inlets should open farther as each fan turns on to allow more air into the building as more air is being pushed out by the fans. If the **UP** or **DOWN** button is pressed the PEC will display **Auto** and the current position of the inlet.

Testing and calibrating the inlet

Follow these steps to test and calibrate the inlet to prepare it for use.

1. When the PEC is turned on for the first time, the inlets can be positioned manually. At the factory Inlet Manual Operation, parameter #37, is set to ON. When Manual Operation is on, pressing the **UP** button will open the inlets and the **DOWN** button will close the inlets. Check to see that the inlet moves in the proper direction when pressing the **UP** and **DOWN** buttons. If the inlet moves in the opposite direction the open and close wires are reversed. Correct the wiring and retest.

WARNING: always turn off all power before removing the cover and making changes to the wiring.

2. Press and hold the **UP** or **DOWN** button and watch the inlet position reading. When the inlet is opening the position reading should increase and, when the inlet is closing the position reading should decrease. If the position reading is changing in the opposite direction the feedback wires are reversed. Turn off the power and change the negative and positive wires around to reverse the direction of the feedback. Now retest the position reading.
3. Press the **DOWN** button to move the inlet to its fully closed position. Adjust the internal limit switch in the actuator to this position. This switch stops the actuator from closing further.
4. Press the **UP** button to move the inlet to its fully opened position. Adjust the internal limit switch in the actuator to this position. This switch stops the actuator from opening further.
5. Start the calibration process by adjusting Inlet Calibration, parameter #40 to ON. The calibration process will open and close the inlet and detect the location of the limit switches. When calibrated, the fully closed position will be 0% and the fully open position will be 100%. The calibration will take a number of minutes but can be aborted at any time by pressing the **RETURN** button. If the calibration process is aborted the inlet will not be controlled properly by the PEC. If the calibration does not work check the limit switches and restart the calibration. If the calibration still does not work, see the Troubleshooting section in Appendix C.

The inlet is now calibrated and ready for use.

Automatic inlet operation

The following steps explain how to program the PEC to control the inlet automatically. The inlet should be tested and calibrated before starting this section, see Testing and Calibrating above. If the inlet has been tested and calibrated continue with these steps.

1. When the inlet is controlled automatically by the PEC it is positioned according to the settings for parameter 4 and parameters 14 to 18. These parameters should be programmed so the inlet opens wider as more stages turn on. In order to know what to program these parameters to, adjust the inlet by pressing the **UP** and **DOWN** buttons while in manual operation and take note of the position reading for each of the desired positions. The inlet should open further each time another stage turns on. When the desired position reading is known the parameter can be programmed to the correct setting.

2. Adjust the Inlet Manual Operation parameter #37, to OFF. The PEC will now position the inlet automatically.
3. If the inlet begins hunting (starting and stopping), around the desired position the Inlet Hysteresis is set too low. To increase the Inlet Hysteresis, adjust parameter #38 to a higher value. If Inlet Hysteresis is adjusted too high the inlet will not be positioned accurately. It is a good idea to decrease the Inlet Hysteresis until the inlet begins to oscillate and then increase the setting just above the point where it oscillates. This will set the inlet system to operate with the most accuracy.
4. If a jam alarm occurs when the inlet is being positioned, check to see if the inlet is stuck. If it is not, the alarm is occurring because the Inlet Time Out setting is too short. Increase the Inlet Time Out, parameter #39, to a higher setting. The Inlet Time Out parameter represents the length of time the PEC will wait to get the correct signal from the inlet. If the PEC does not get the correct signal, the PEC thinks that the inlet is stuck and a jam alarm will appear.
5. The PEC and inlet are now set for automatic operation. When the **UP** or **DOWN** button is pressed while in automatic operation, the PEC will display Auto and then the current position of the inlet in percent of the total opening.

Methods of use

Programs

The PEC has four programs which can be selected as the operating program. To take advantage of the programs, adjust them for different climate settings. They can be used for different kinds of livestock or used at different stages of maturity for the livestock. Time is saved by simply changing the operating program, instead of adjusting every parameter. Remember to mark all changes to the programs in the Blank Program Tables in Appendix D to keep track of the settings.

Stage 5 proportional interval

Stage 5 can be programmed to operate as a proportional cycle timer. When Stage 5 operates as a proportional cycle timer it provides better control of the temperature and more efficient operation. To do this, Stage 5 will be on for a portion of the cycle or interval. The time Stage 5 is on will change depending on the temperature.

To program, set Stage 5 Proportional (parameter #29) to on. This feature works when the Stage 5 Operation (parameter #28) is set to either heat or cool. The Stage 5 Interval Length (parameter #30) is adjustable between 5 and 25 minutes. The Stage 5 P-Band (parameter #31) begins at the Stage 5 Turn On point (parameter #12). When the temperature is within the P-Band range, Stage 5 will be turned on for a portion of the interval. Stage 5 will cycle on and off once during one interval. The on time and off time will change proportionally to the change in temperature. If the temperature exceeds the P-Band, Stage 5 will be on all the time.

Alarm messages

Alarm	Description
Err	Error - an incorrect key has been pressed
A Ht	Alarm High Temperature - temperature is above the high temp alarm setting
A Lt	Alarm Low Temperature - temperature is below the low temp alarm setting
A LP	Alarm Low Power - the line voltage is low
A Pd	Alarm Probe Disconnect - the temperature sensor is disconnected
A PS	Alarm Probe Short - the temperature sensor is short circuited
A PF	Alarm Power Failure - indicates a power interruption has occurred
A IE	Alarm Internal Error - indicates an internal error has occurred
A Jo	Alarm Jam Open - the inlet can not open
A Jc	Alarm Jam Close - the inlet can not close
A Fb	Alarm Feedback - the feedback wires are damaged
UoFF	Ventilation Off - ventilation has been turned off in the program

Reasons for alarms to activate

Err The Err message appears when an incorrect key has been pressed or if an attempt has been made to change a parameter while memory protect is on. The Err message will appear for 2 seconds and then disappear.

A Ht The high temperature alarm appears when the room temperature is above the high temperature alarm setting (parameter #20). Check if the fans are operating properly. This alarm may occur on very hot days when the desired room temperature can not be maintained.

A Lt The low temperature alarm appears when the room temperature is below the low temperature alarm setting (parameter #19). Check if the heater is operating properly.

A LP The low power alarm turns on when the line voltage drops below 180 for 230 VAC operation or below 90 for 115 VAC operation. This indicates a problem with the electrical service of the building. The control may operate erratically if the voltage drops below these levels.

A Pd This indicates the temperature sensor is disconnected. The sensor wire may be broken or damaged somewhere.

A PS This alarm indicates the temperature sensor is short circuited. The sensor or wire may be damaged somewhere.

NOTE: When a **A Pd** or a **A PS** alarm occurs, the heating and cooling stages will turn off and the variable stages will run at idle speed.

A PF The Power Failure alarm appears when there has been an interruption in the power. The control will operate properly and the alarm can be cleared by pressing the RETURN button.

A IE When this alarm appears it indicates an internal error has occurred. To clear this alarm check through the parameters; adjust and store the ones that are incorrect. Next, turn the power off and then back on and the alarm will clear. **NOTE:** A parameter must be changed and stored and the power turned off and on before the alarm will be cleared. Another way to clear the alarm is downloading the factory programs. This will reset all the parameters to the factory settings and then they must be programmed to the desired settings again. Consult your dealer or Phason for information to prevent this problem from happening again.

A Jo A jam open alarm appears when the PEC is trying to open the inlet but does not receive the correct response from the positioning motor. This may happen if the inlet is mechanically stuck or the feedback wires are reversed. Also, the jam open alarm may occur if the inlet has not been calibrated.

A Jc A jam close alarm appears when the PEC is trying to close the inlet but does not receive the correct response from the positioning motor. This may happen if the inlet is mechanically stuck or the feedback wires are reversed. Also, the jam close alarm may occur if the inlet has not been calibrated.

A Fb A feedback alarm occurs when the feedback wires are short circuited or damaged.

VoFF VoFF is displayed when VENTILATION (parameter #24), is turned OFF. When this is displayed, the variable speed stages and the cooling stages will be turned off. The heating stage(s) will operate normally.

Care and maintenance

Moisture will not cause a problem with the control if the proper care is taken in installation. The control's enclosure is made of fire retardant plastic and is sealed with a rubber gasket. The sensor entry is sealed with a liquid tight cable connector.

Caution should be taken when washing the room with a high pressure washer. DO NOT direct a high pressure washer at the control. In order to clean the control, wipe it with a damp cloth.



Be sure power is off before cleaning to avoid electrical shock.

Maintenance

1. To prevent damage to the control, after the first two weeks of operation remove the cover from the unit and check for moisture inside. Be sure to turn off the power to the control before opening the cover.
2. If moisture is present, wipe it out with a dry cloth and check the cable entry points and rubber gasket for proper sealing.
3. If the cable connectors are not sealing, apply silicon sealant around the cable.

WARNING: If silicone is used, be aware that some silicone sealants release acetic acid while curing. Let silicone cure completely (1 to 3 days), before closing the control or the control may be damaged and the warranty VOID.

4. Check the control again after two weeks to ensure that it is properly sealed.

The control should be opened and inspected once a year for moisture. Proper care and maintenance will extend the life of the control.

Power factor correction

Adjusting the P-Band to correct for a particular power factor may improve your ventilation system's performance. Power factor correction is generally unnecessary and there is no danger of damage being done to the control or motor if it is not done. As a result of different power factors between the many makes and models of fan motors, the actual P-Band may be less than the P-Band setting displayed by the control.

If the power factor of the motor is available, use the chart of correction numbers, (listed in the table below), and CALC 1 below to calculate the P-Band setting required in order to get the desired P-Band. A power factor of 0.8 or greater will cause an insignificant change to the P-Band and does not need to be corrected.

CALC 1: P-BAND SETTING = DESIRED P-BAND x CORRECTION NUMBER

Example 1: To have a 6°F P-Band with a motor which has a power factor of 0.7, set the P-Band to 7.5°F. (6°F x 1.25 = 7.5°F)

If the power factor is not known the correction number may be measured. Follow the steps below.

Power factor	Correction
1.0	1.00
0.9	1.05
0.8	1.10
0.7	1.25
0.6	1.33
0.5	1.60

Table 5: Power factor correction

1. Set the Minimum Ventilation parameters, (# 2 and 3) to the desired values.
2. Set the P-Bands to 10°F, parameters # 6 and 9.
3. Observe the ROOM TEMPERATURE.
4. Adjust the TEMP SET, (parameter # 1) to equal the ROOM TEMPERATURE and Stage 2 Start P-Band2, (parameter # 8) to 0. Now, the Stage 1 and Stage 2 fans will be running just above minimum ventilation.
5. Slowly decrease the TEMP SET, (parameter # 1) and listen to the fans increase in speed.
6. Observe the TEMP SET, (FULL SPEED TEMP SET) at which the motors reach full speed.
7. Calculate the Correction number for the motors as follows:

CALC 2: 10°F ÷ (FULL SPEED TEMP SET - ROOM TEMPERATURE) = Correction number

Example 2: ROOM TEMP = 75°F and FULL SPEED TEMP SET = 82°F

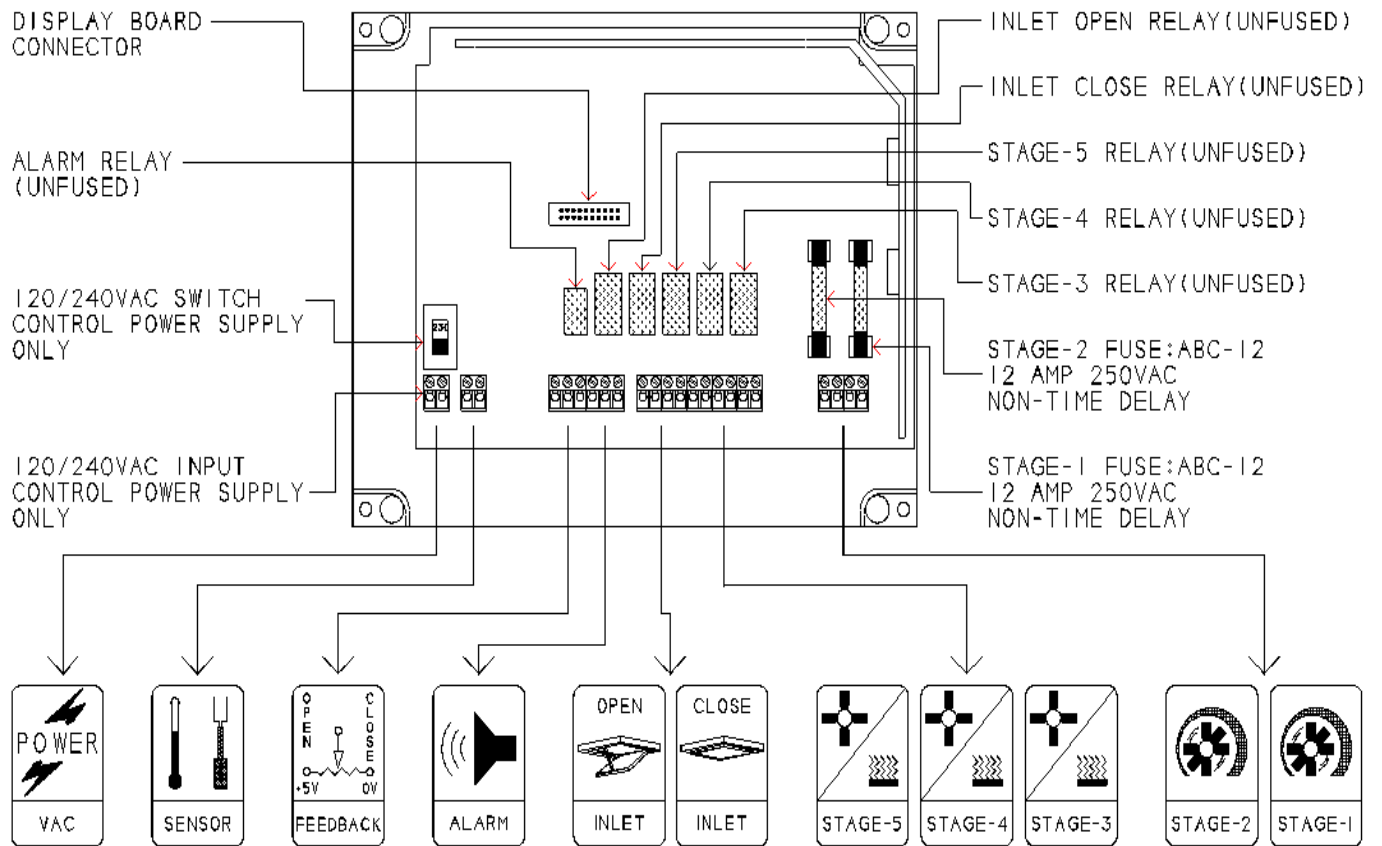
Correction Number = 10°F ÷ (82°F - 75°F) = 1.43

Now use CALC 1 above to find the P-Band setting.

Appendix A: wiring diagrams

- ◆ Installation overview on page 35
- ◆ General warnings on page 36
- ◆ Mounting instructions on page 37
- ◆ Grounding and sealing on page 37
- ◆ 230 VAC control power on page 38
- ◆ 115 VAC control power on page 38
- ◆ Temperature sensor on page 39
- ◆ Four-zone averaging on page 39
- ◆ Manually extending the sensor on page 40
- ◆ Alarm siren installation en page 41
- ◆ Alarm panel installation on page 41
- ◆ Linear actuator installation on page 42
- ◆ DC linear actuator on page 42
- ◆ DC power supply on page 43
- ◆ AC linear actuator on page 43
- ◆ 230 VAC heat/cool stages on page 44
- ◆ 115 VAC heat/cool stages on page 44
- ◆ Heat/cool stage furnace on page 45
- ◆ 230 VAC variable speed fan on page 46
- ◆ 115 VAC variable speed fan on page 46
- ◆ Correct three-phase wiring on page 47
- ◆ Incorrect three-phase wiring on page 47
- ◆ Heat/cool bypass switch on page 48
- ◆ Variable stage bypass switch on page 48

Installation overview



General warnings



Be sure power is off before doing any wiring.

Install all equipment according to the applicable local electrical codes.

The PEC should be installed by a qualified electrician.

Most variable speed fan motors draw more current at fractional speeds than at full speed. Fan motor specifications show current draw at full speed. The increase in current draw may be as much as two times the rated current. Current over 7.5 Amps will cause overheating and eventual failure of the PEC. Please check current requirements for the fan motor by either measuring current draw at all speeds from idle to full speed or consult the dealer for information on the particular fan.

CAUTION: Only permanent split capacitor motors appropriate for variable speed control, or shaded pole motors, can be used on the variable stages.

ATTENTION: Seulement moteurs du condensateur fendus permanents appropriés pour contrôle de la vitesse variable ou ont ombragé des moteurs de la perche, peut être utilisé sur les étapes variables.

DO NOT mount power contactors inside the PEC enclosure. Power contactors create electrical noise which may cause the PEC to work improperly.

Warning: Phason controls are designed and manufactured to provide reliable performance, but they are not guaranteed to be 100% free of defects. Even reliable products may experience occasional failures, and this possibility should be recognized by the User. If Phason products are used in a life support ventilation system where failure could result in loss or injury, the user should provide adequate back-up ventilation, supplementary natural ventilation or an independent failure alarm system. The user's lack of such precautions acknowledges their willingness to accept the risk of such loss or injury.

A false '**R PF**' alarm is due to electrical noise caused by high voltage transients in certain installations. Electrical noise varies according to the type of equipment installed, the wiring layout and many other factors. It's effects are not apparent in most installations but over time it can cause degradation of electronic circuits and of relays and power contactors. These transients can cause unreliable operation of your equipment if they are not properly controlled. Therefore, snubbing filters must be installed on all inductive loads for installations of this type. The filters must be connected in parallel with the load so the snubbing filter may absorb the transient energy.

Phason has snubbing filters available for different types of equipment.

Mounting instructions

To mount the PEC, remove the four screws in the front cover and lift off the cover. The cover can be unplugged from the bottom to make wiring easier. Mount the box to the wall with the four wood screws provided with the control. Insert the screws into the large holes in each corner of the box and tighten.

Use the knockouts provided at the bottom of the enclosure for mounting cable connectors. **DO NOT** make additional holes in the enclosure. This should not be done and will void the warranty! All wires should enter the enclosure through the electrical-knockout holes provided and all grounds should be connected to the ground plate. When installing a control, close attention should be taken to route the wires, inside the control, away from the control's electronics so that wires are not draped across the components which may result in a part being broken or damaged which will affect the reliability of your control.

DO NOT mount the bottom enclosure rotated 180° which places the electric-knockouts at the top of the enclosure. This should not be done and may void warranty! When this is done corrosion causing moisture is more likely to enter the control and wiring will be prone to contact with the electronic circuitry which may cause damage to components as stated above.

Grounding and sealing



A - Connect all ground wires to ground studs.

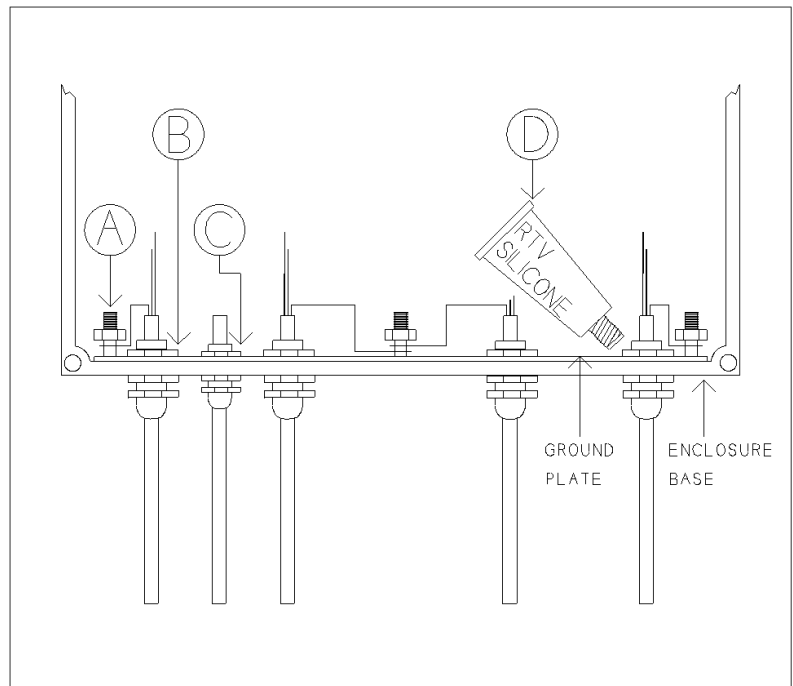
B - Use 3/4" liquid tight wire connectors for large holes.

C - Use 1/2" liquid tight wire connectors for small holes.

D - Use RTV silicone or equivalent sealant to seal cable entry points if liquid tight wire connectors are not used.



If silicone is used, be aware that some silicone sealants release acetic acid while curing. This can cause corrosion damage to the control. Let the silicone cure completely (1 to 3 days), before closing the control or the control may be damaged and the warranty VOID.



230 VAC control power

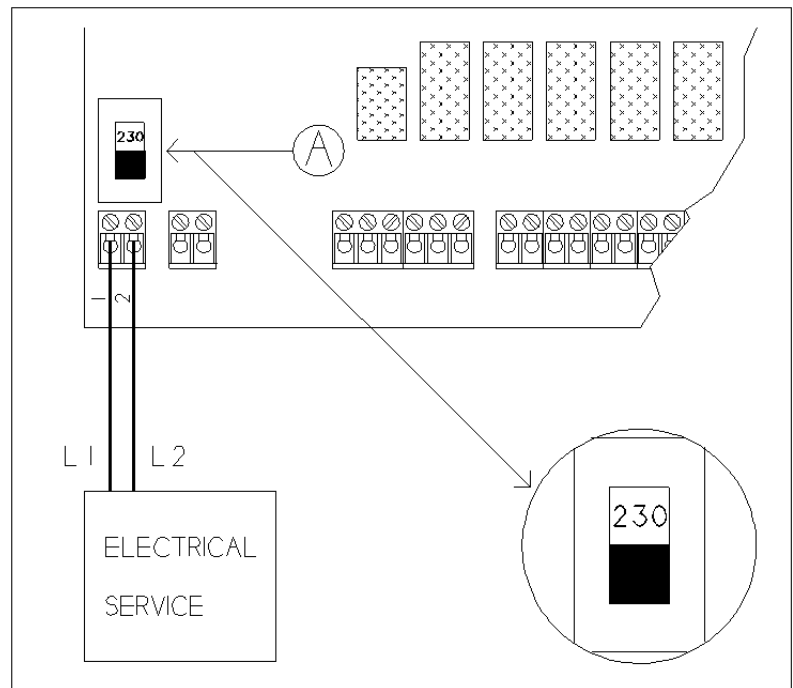


Connect the power to terminals 1 and 2.

A) Set switch to the 230 VAC position.



See page 47, for instructions for connecting the PEC to three phase power.

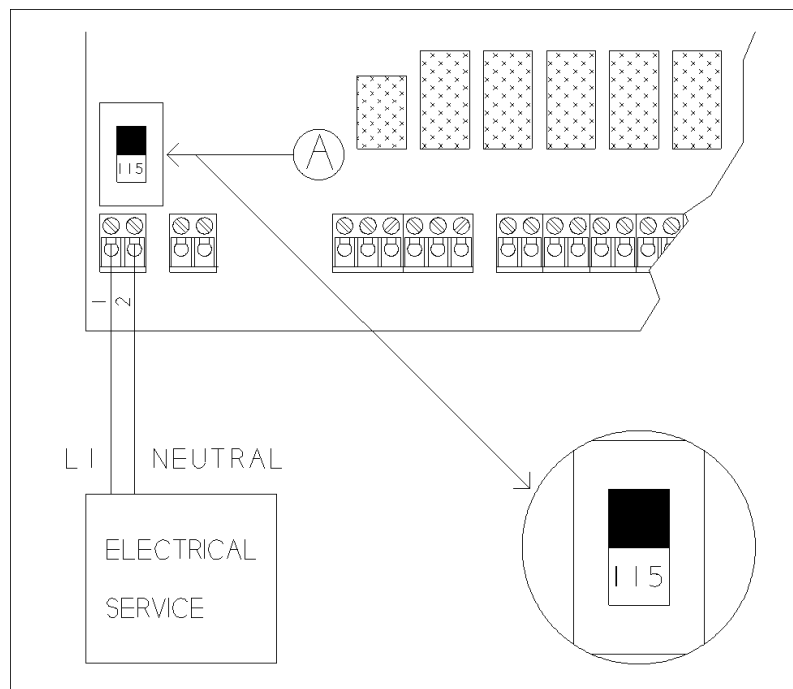


115 VAC control power

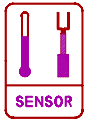


Connect power to terminals 1 and 2.

A) Set switch to 115 VAC position



Temperature sensor



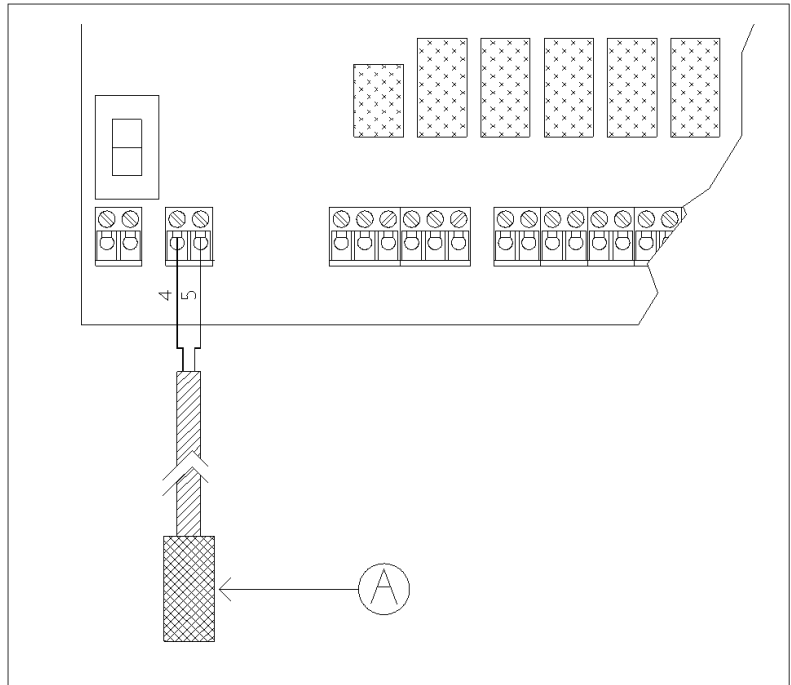
Connect the sensor to terminals 4 and 5.

A) The temperature sensor can be extended if so desired. You may purchase an extended sensor or extend a sensor manually. To manually extend the sensor, follow the instructions on the following page.

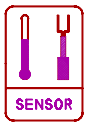
Do not run the probe cable in the same conduit as AC power cables.

Do not run the sensor cable beside AC power cables or near electrical equipment.

When crossing other cables or power lines, cross them at a 90 degree angle.



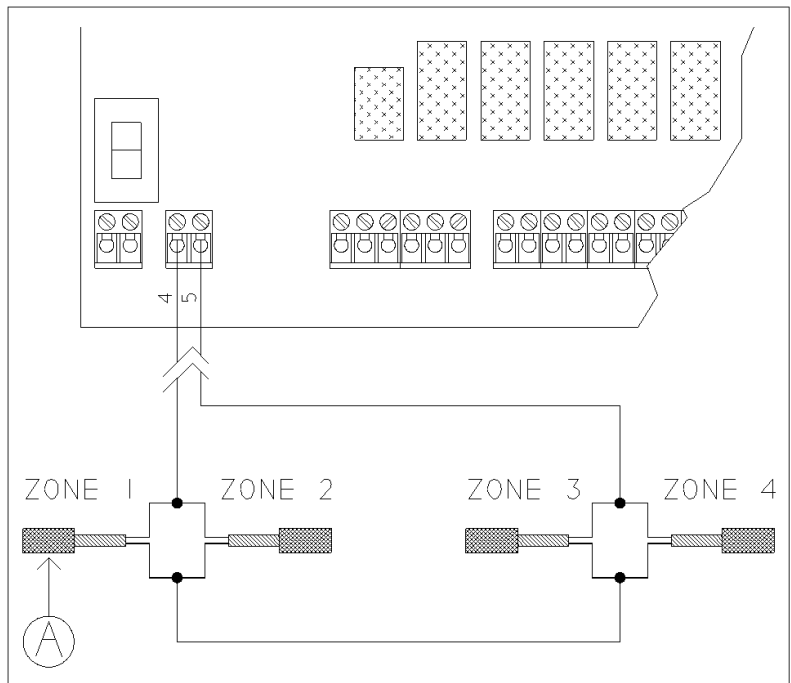
Four-zone averaging



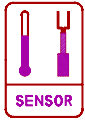
Connect the sensor to terminals 4 and 5.

The PEC is capable of monitoring the temperature in four areas and operating accordingly to the average. Additional probes are available. To manually extend the sensor, follow the instructions on the following page.

A) The PEC can operate with one or four probes connected.



Manually extending the sensor



To extend the sensor, use 2 wire 18 or 20 AWG jacketed cable. To splice two wires together follow the steps below and refer to the diagram.

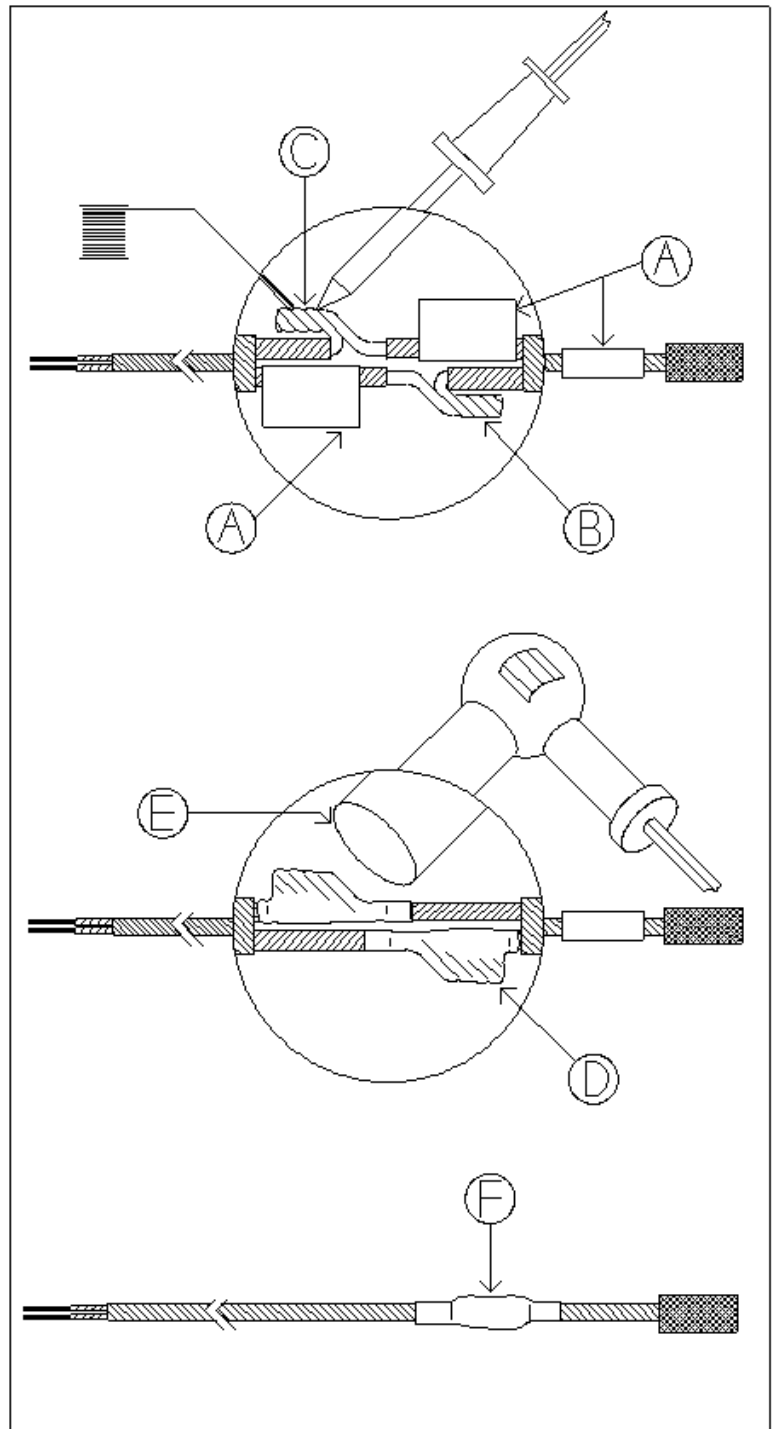
- A) Slide pieces of heat shrink tubing on the wire ends as shown.
- B) Strip the ends of wire and twist together.
- C) Using a soldering iron and solder, connect the twisted wire ends together.
- D) Slide the heat shrink tubing over the soldered connection.
- E) Heat the tubing with a hot air gun (paint stripper).
- F) When finished, the splice should be completely sealed.

NOTE: If the unit operates erratically with the extended sensor, try running the extended sensor on a different path or shortening it.

Do not run the probe cable in the same conduit as AC power cables.

Do not run the sensor cable beside AC power cables or near electrical equipment.

When crossing other cables or power lines, cross them at a 90 degree angle.



Alarm siren installation



Connect alarm to terminals 14, 15 and 16.

14 - COMMON

15 - NORMALLY OPEN

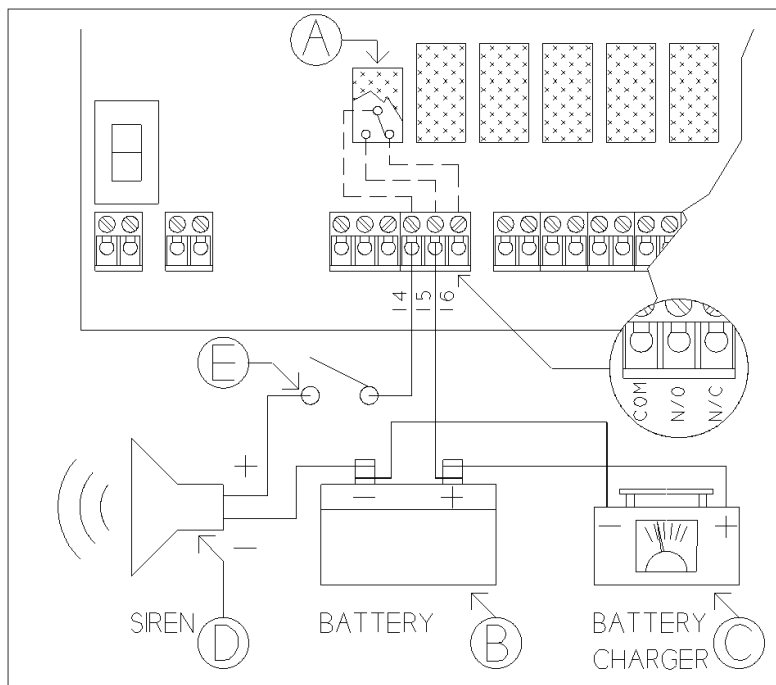
16 - NORMALLY CLOSED

A - See the PEC Electrical Ratings section for the alarm relay ratings.

B & C - Use a backup battery and an appropriate charging system.

D - The siren ratings must not be greater than the alarm relay ratings.

E - Alarm disable switch.



Alarm panel installation



Connect the alarm panel / auto-dialer to terminals 14, 15 or 16.

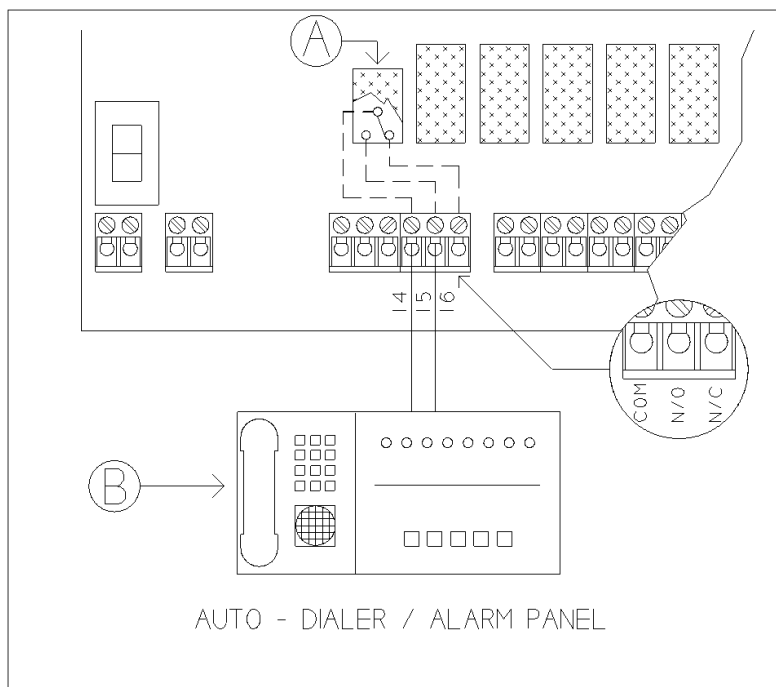
14 - COMMON

15 - NORMALLY OPEN

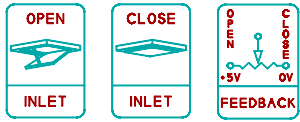
16 - NORMALLY CLOSED

A - See the PEC Electrical Ratings section for the alarm relay ratings.

B - Consult the Alarm Panel / Auto-dialer owner's manual for proper installation guidelines.



Linear actuator installation



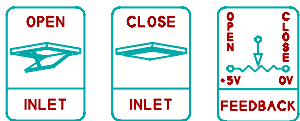
In a typical installation, a linear actuator is physically connected to the inlets with a network of cables and pulleys. These inlets are generally small and located in the ceiling or walls and are usually spring loaded to aid in closing the inlet. In other installations, larger inlets may be connected to the actuator directly or with a linking arm. A system operates with the most precision when using the largest amount of stroke that is feasible with the actuator.

In order for the PEC to control the linear actuator, the actuator must have limit switches and a feedback potentiometer. Most linear actuators are available with internal adjustable limit switches and potentiometer feedback. A 10k ohm 10 turn feedback potentiometer is desired but it can range between 1k and 100k ohms.

Phason recommends the use of Grainger part # 5A652, von Weise (Fasco) model # V00099BA76, or equivalent DC linear actuator which can be used with a DC power supply. Depending on your equipment, you may require a bracket to prevent the actuator arm from rotating while it is extending.

PEC controls that have a DC linear actuator connected should have a snubber filter installed. It should be installed across (in parallel with) the actuator, so it can absorb the transient energy that the actuator motor generates which will extend the service life of the control's signal relays. A snubber filter is included in Phason's DC Actuator Power Supply or may be purchased separately.

DC linear actuator



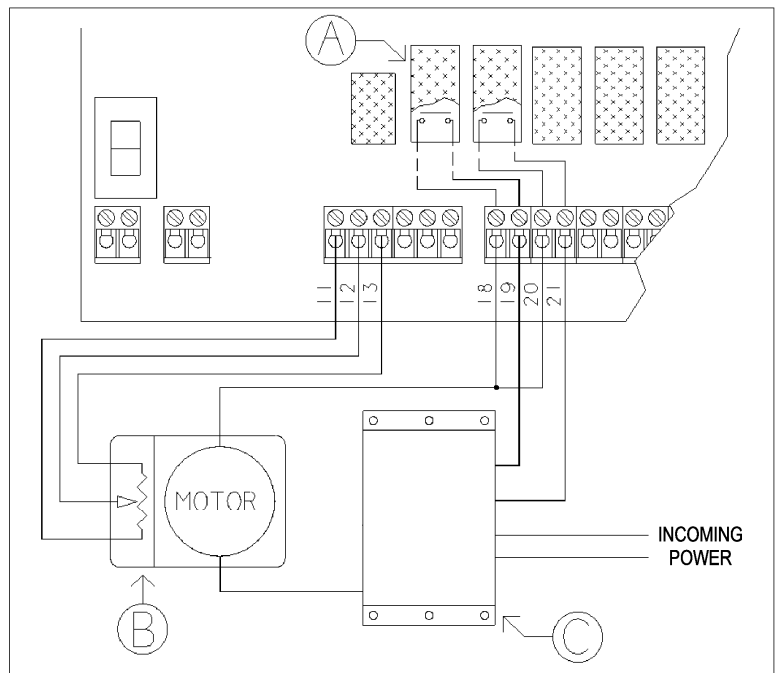
Connect the actuator to terminals 18 and 19 for the OPEN contact and 20 and 21 for the CLOSE contact. Connect the feedback to terminals 11, 12 and 13.

11 - Positive
12 - Feedback
13 - Negative

A - Relay Ratings: 4.4 A at 120 VAC, 2.2 A at 230 VAC, 5 A at 30 VDC

B - DC Linear Actuator

C - Power supply for a DC linear actuator.
PEC Controls that have a DC linear actuator connected must have a snubber filter installed.



DC power supply

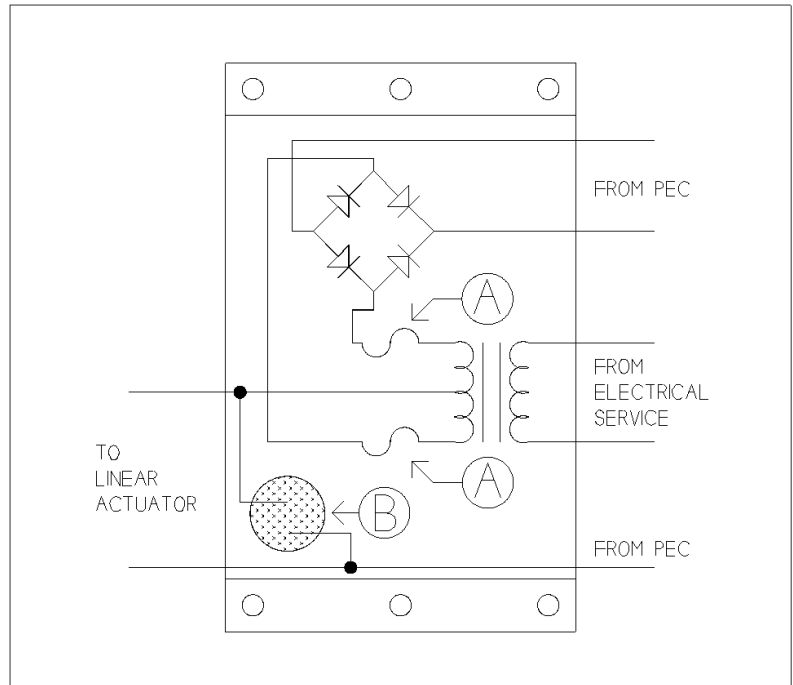


This diagram shows a power supply for a DC linear actuator.

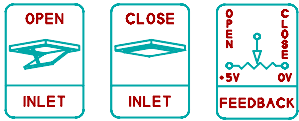
A - The power supply contains two 5 AMP slow-blow fuses and electrical noise filters.

B - Snubber filter installed. A filter should be installed to protect the signal relays on the PEC from electrical noise.

The power supply must not supply more voltage than what the actuator is rated for.



AC linear actuator

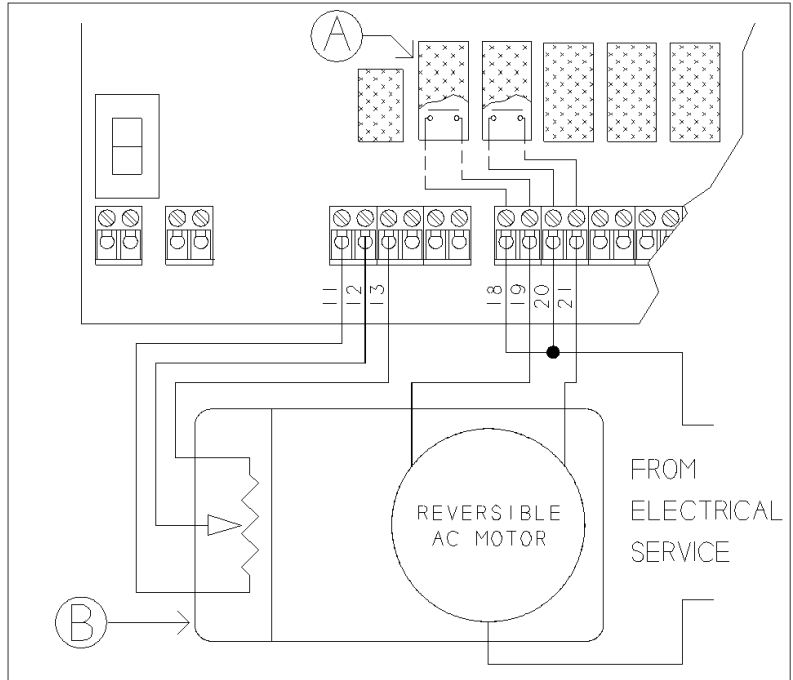


Connect the actuator to terminals 18 and 19 for the OPEN contact and 20 and 21 for the CLOSE contact. Connect the feedback to terminals 11, 12 and 13.

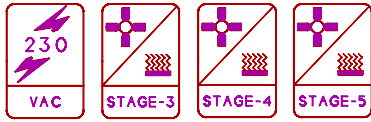
11 - Positive
12 - Feedback
13 - Negative

A - Relay Ratings: 4.4 A at 120 VAC, 2.2 A at 230 VAC, 5 A at 30 VDC

B - AC linear actuator must be connected to the proper supply voltage.



230 VAC heat/cool stages



Connect Stage 3 to terminals 26 and 27.
Connect Stage 4 to terminals 24 and 25.
Connect Stage 5 to terminals 22 and 23.

A - Relay Ratings: 2.2 A at 230 VAC,
general-purpose (resistive)

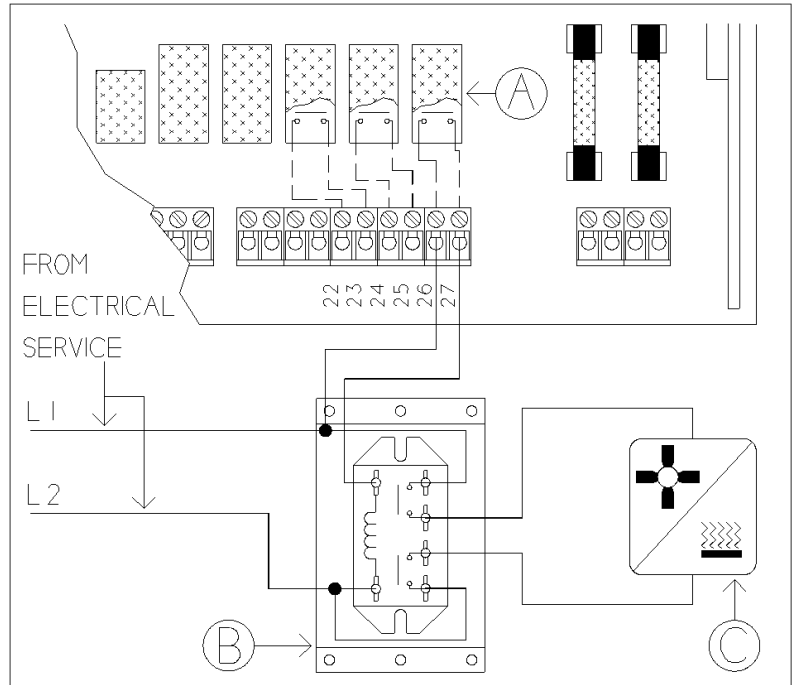
1/6 HP at 230 VAC, PSC motor

B - 230 VAC power contactor.

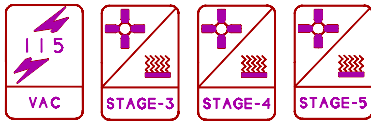
C- Load type: fan or heater.



Install according to applicable local
electrical codes.



115 VAC heat/cool stages



Connect Stage 3 to terminals 26 and 27.
Connect Stage 4 to terminals 24 and 25.
Connect Stage 5 to terminals 22 and 23.

A - Relay Ratings: 4.4 A at 120 VAC

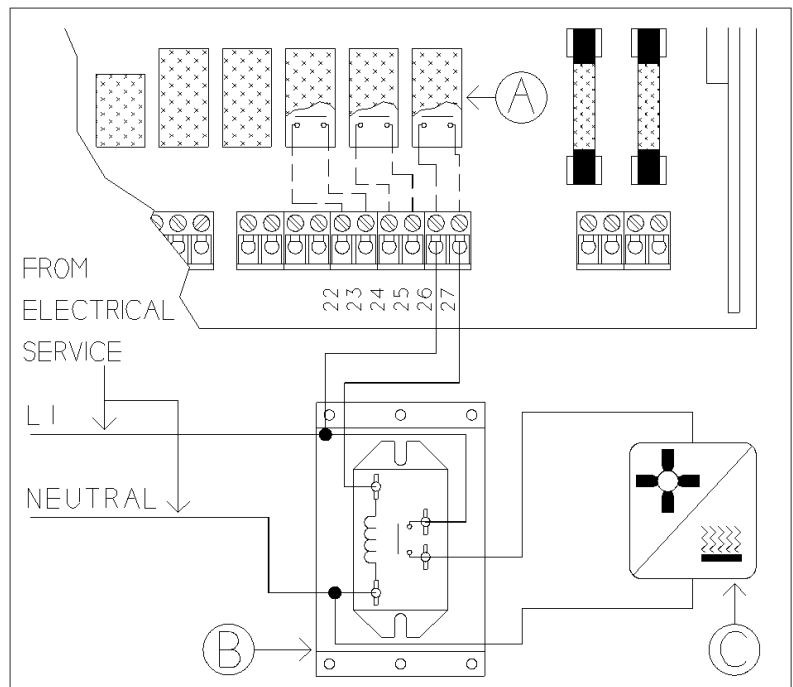
360 W tungsten at 120 VAC

B - 115 VAC power contactor.

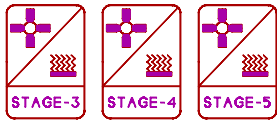
C - Load type: fan or heater.



Install according to applicable local
electrical codes



Heat/cool stage furnace



Connect Stage 3 to terminals 26 and 27.
Connect Stage 4 to terminals 24 and 25.
Connect Stage 5 to terminals 22 and 23.

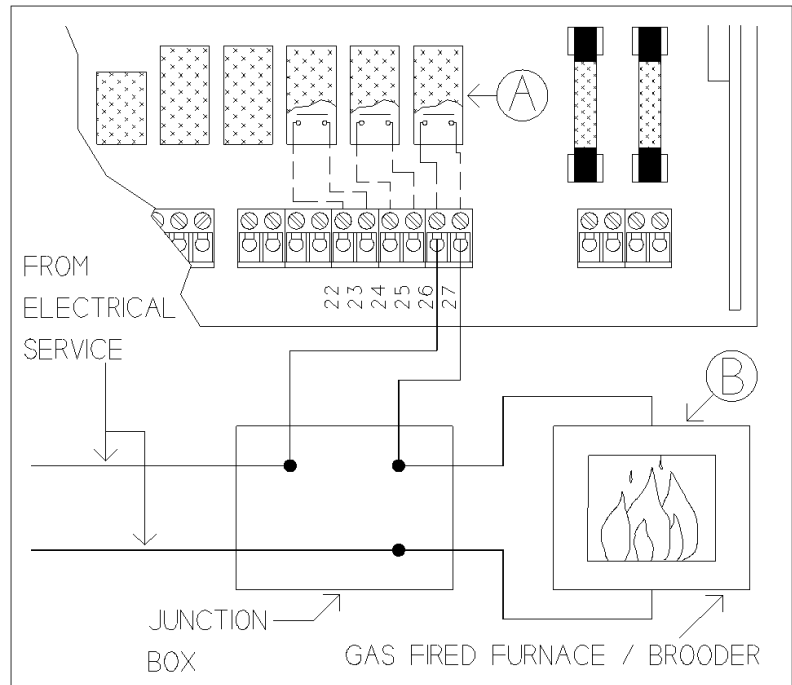
A - Relay Ratings: 4.4 A at 120 VAC, 2.2 A at 230 VAC, general-purpose (resistive)

1/6 HP at 230 VAC, PSC motor

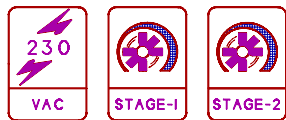
B - This configuration shows the PEC connected to the power connections for a gas fired furnace or brooder.



Gas furnaces using hot-surface ignition or glow plugs may draw a higher current than indicated on their nameplate and require a power contactor. Consult furnace agent for details.



230 VAC variable speed fan



Connect Stage 1 to terminals 34 and 35.
Connect Stage 2 to terminals 32 and 33.

A & B - Stage 1 and 2 fuse type: 12 Amp, 250 VAC ceramic fuse.

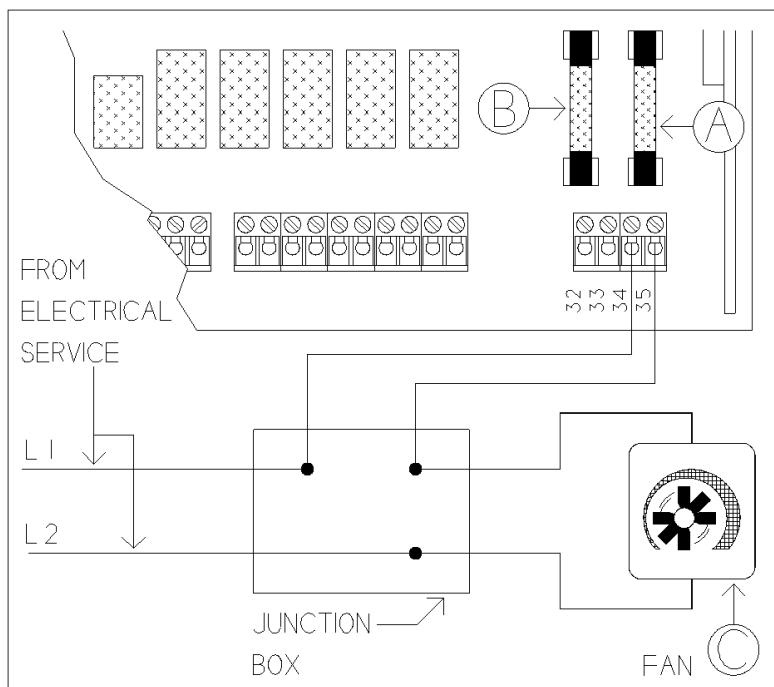
C - Variable speed fan.



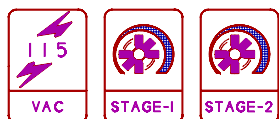
Wire according to applicable local electrical codes.



For three-phase wiring instructions,
see page 47.



115 VAC variable speed fan



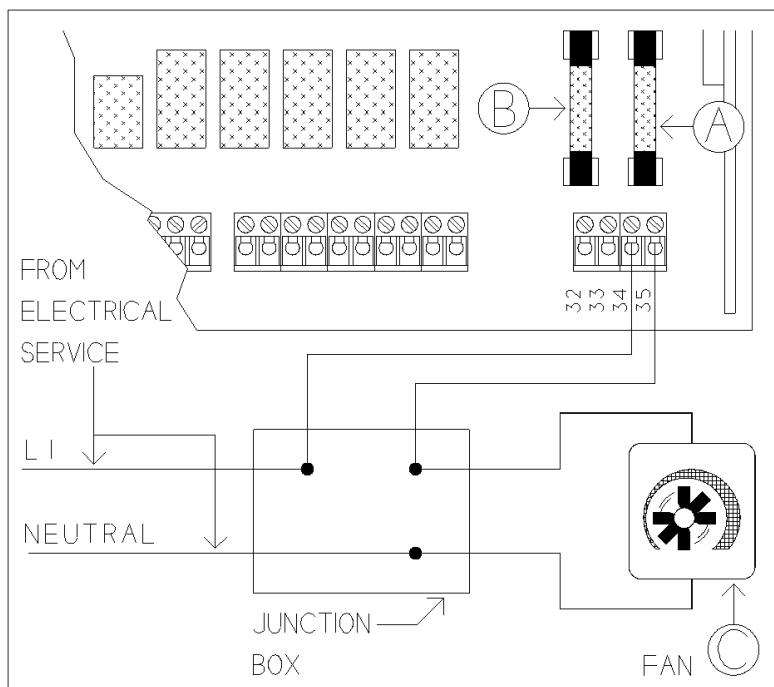
Connect Stage 1 to terminals 34 and 35.
Connect Stage 2 to terminals 32 and 33.

A & B - Stage 1 and 2 fuse type: 12 Amp, 250 VAC ceramic fuse.

C - Variable speed fan.



Wire according to applicable local electrical codes.

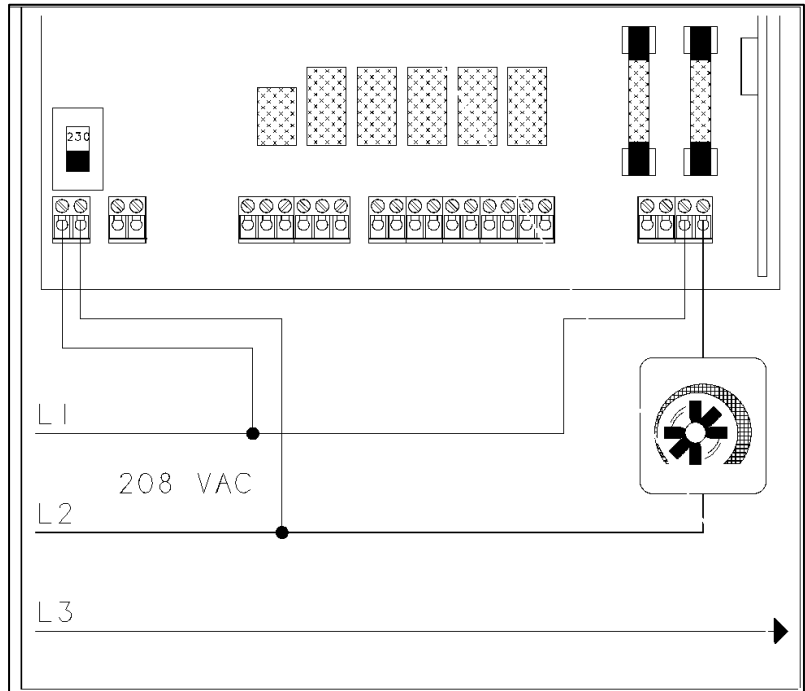


Correct three-phase wiring



When connecting the PEC to a 3 phase system, the control and all variable speed fans must be connected across the same 2 of the 3 phases and the control's power switch must be set to 230. If this is not done the variable speed fans will run erratically.

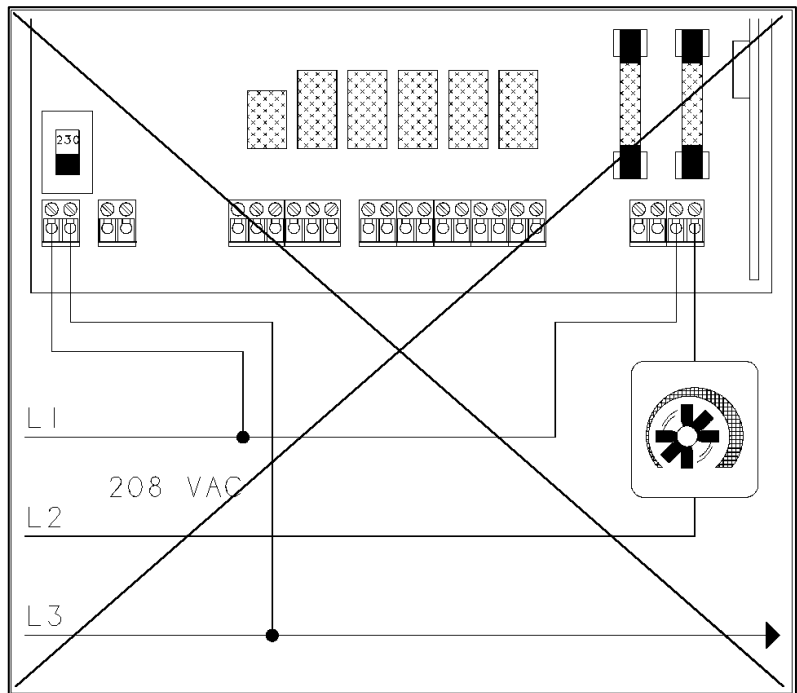
DO NOT connect 115 VAC power to terminals 1 and 2 on the PEC and power the variable speed fans with 208/230 VAC.



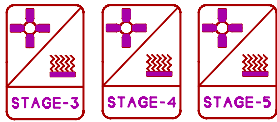
Incorrect three-phase wiring



If the control power and the variable speed stages are wired to different phases, the fans will operate erratically. This will also happen if the PEC is powered with 115 VAC and the variable speed fans are powered with 208/230 VAC.



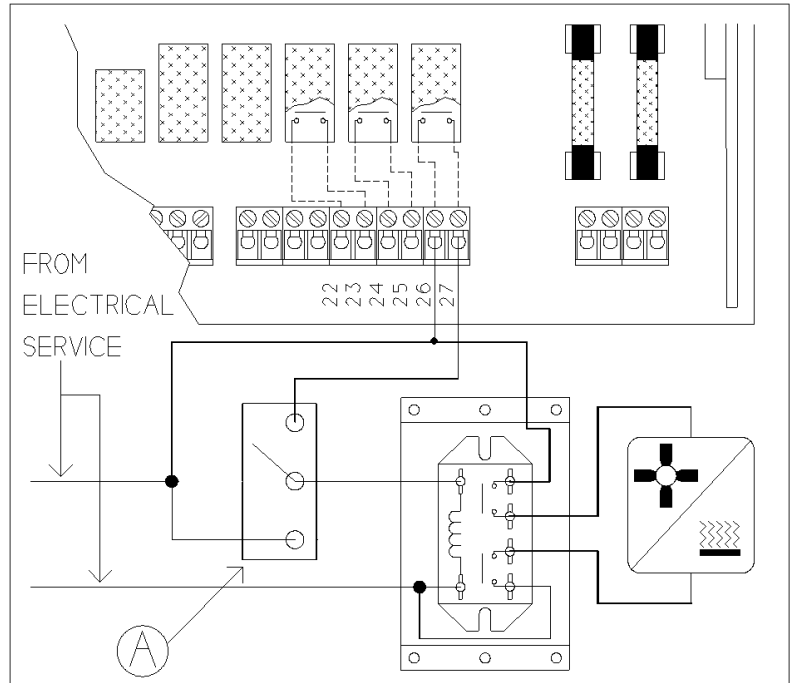
Heat/cool bypass switch



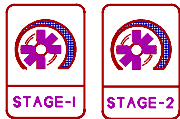
A - A bypass switch may be installed so the stage can be operated manually, turned off, or controlled automatically by the PEC. When the switch is in the upper position the stage will be controlled automatically. When the switch is in the center position the stage will be off, and when the switch is in the lower position (manual position) the stage will be on.

Phasor power contactor units have a bypass switch included.

This switch is NOT a disconnect switch



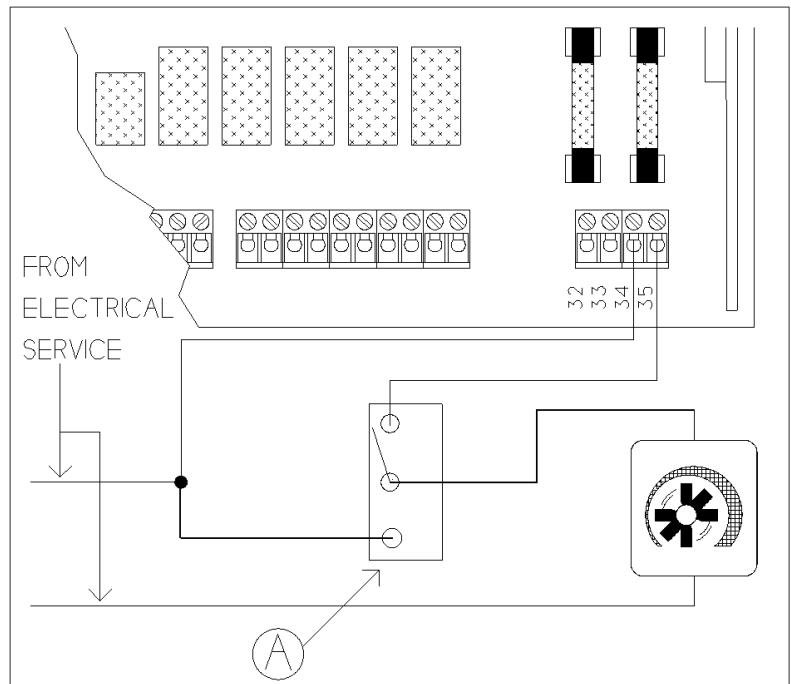
Variable stage bypass switch



A - A bypass switch may be installed so the fan can be operated manually, turned off, or controlled automatically by the PEC. When the switch is in the upper position the fan will be controlled automatically. When the switch is in the center position the fan will be off, and when the switch is in the lower position (manual position) the fan will be on full speed.

Connect a "SPDT center off" switch.

This switch is NOT a disconnect switch.



Appendix B: test procedure

- ◆ Built-in test procedure on page 50
- ◆ Input test on page 50
- ◆ Memory test on page 50
- ◆ Display test on page 51
- ◆ Variable stage test on page 51
- ◆ Relay test on page 52
- ◆ Reset test on page 52

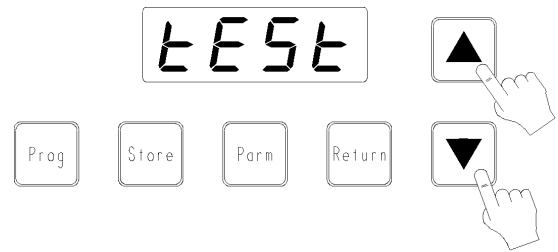
Built-in test procedure

The PEC has a built in test procedure. The test should be performed after the control has been installed and may be used at any time to check the operation of the control. The test procedure tests the circuitry in the control and each stage individually. Follow the instructions below to step through the test procedure.



If an alarm system is connected, be aware that it is normal for the alarm to be activated during most of the test procedure.

In order to start the test procedure, the power to the PEC must be off. Then, while holding the UP and DOWN buttons in, turn on the power. The PEC will start up in the test mode.



Input test

Press the **PROG** button once. The PEC will display a number. This number should be between 100.0 and 125.0.

Press the **PROG** button again. The PEC will display a number that corresponds to the position of the inlet. If the inlet is opened or closed, this number will change accordingly.

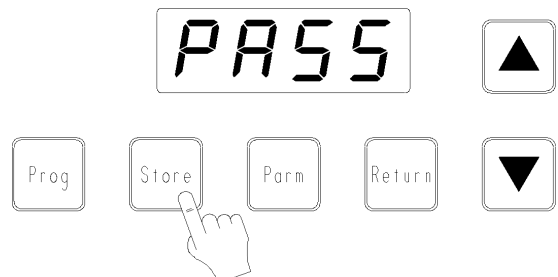
Press the **PROG** button again and the PEC will display the temperature. If the temperature displayed is not correct, check if the sensor is installed properly.



Memory test

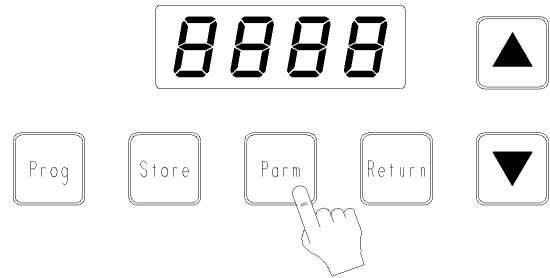
Press the **STORE** button. The PEC will display **PASS** if the factory programs are in memory. It will display **FAIL** if the programs in memory have been changed in any way from the factory settings.

See Reloading the factory programs under the Getting to know the PEC section in this user's guide to reload the factory programs.



Display test

Press the **PARM** button to perform the display test. The PEC will display **8888** and then will count from 0 to 9 on each digit. After the display test is done the PEC will display "**t d5**" which stands for test display.



Variable stage test

Press the **UP** button once. This will start the variable speed fan test. The display should be flashing **tSP 1** and **oFF**, ("**tSP 1**" means test variable speed stage 1). Press the **UP** button again. Now the display should flash **tSP 1** and **FULL**, and the Stage 1 fan should be running full speed. Press **UP** again and the fan should be running at approximately half speed, and the display should flash **tSP 1** and **hALF**. Press **UP** again and the fan will run at low speed. The display will flash **tSP 1** and **Lo**.



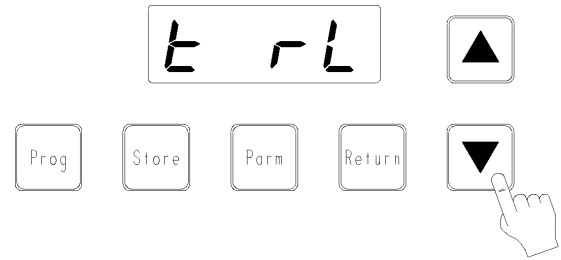
NOTE: some fans may not operate at this low speed.

Pressing the **UP** button four more times will cycle through the Stage 2 fan test. The display will flash **tSP2** and the speed, ("**tSP2**" means test variable speed stage 2). The Stage 2 variable speed fan will run at oFF, FuLL, HALF and Lo speeds like the Stage 1 test. Pressing the **UP** button again will restart the Stage 1 fan test.

If at any time during this test the fans do not operate properly, refer to the troubleshooting guide in Appendix C.

Relay test

Press the **DOWN** button to start the relay test. The display will flash **t rL** and **ALAr**, ("**t rL**" stands for test relay), and the alarm should be on. Press the **DOWN** button again and the display will flash **t rL** and **St 3**. Now Stage 3 should be on and the alarm will be off.

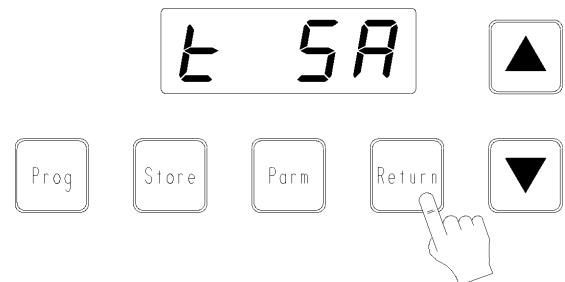


Press **DOWN** again and the display will flash **t rL** and **St 4**, and Stage 4 will turn on and Stage 3 will turn off. Pressing **DOWN** again will turn off Stage 4 and turn on Stage 5. The display will flash **t rL** and **St 5**. Pressing **DOWN** will display **t rL** and **cLoS**. The close relay will be turned on. Press **DOWN** again to test the open relay. The display will flash **t rL** and **oPEn**. Press the **DOWN** button again and the display will flash **t rL** and **ALL**. Now Stages 3, 4, 5 and close will be on. The open and close stages will never be on at the same time. Pressing **DOWN** again will restart the relay test cycle.

If any of the stages did not function properly when activated, refer to the troubleshooting guide in Appendix C.

Reset test

Press the **RETURN** button. This will return the PEC to normal operation. The control will flash **t SA** for one second and then reset itself, ("**t SA**" stands for test sanity circuit). When the control is in normal operation the display will be flashing the room temperature and a power failure alarm, (**RPF**). Press the **RETURN** button to clear the alarm. Other alarms might be displayed if the PEC has not yet been programmed, but this is a normal occurrence.



This completes the test procedure for the PEC. If at any point during this test the PEC or attached equipment did not function properly, refer to the troubleshooting guide in Appendix C.

Appendix C: troubleshooting guide

- ◆ Troubleshooting on page 54

Troubleshooting

Problem	Cause	Solution
No Power/Display	Circuit breaker at service panel off or tripped Wiring incorrect Display board inter-connect cable unplugged from power supply board 115/230 VAC switch in the wrong position	Reset circuit breaker Correct wiring Plug in display board cable Set switch to the correct setting
Stage 1/Stage 2 Fans not running	Wiring incorrect 12 Amp, ABC-12 Fuse(s) open Display board inter-connect cable is not plugged into the power supply board properly Minimum ventilation settings too low (Parameters 2/3) Stage 1/Stage 2 Minimum Idle setting too low (Parameters 32/33) Temperature Set setting above room temperature (Parameter 1) Room temperature below range of Stage 1 / Stage 2 Off-Set-Back (Parameters 5/7) Ventilation is turned off (V off) (Parameter 24) Fan is faulty	Correct wiring Replace fuse(s) Be sure the inter-connect cable is firmly plugged in Increase minimum ventilation settings Increase minimum idle setting Adjust Temperature Set to desired temperature Adjust Off-Set-Back to cover required range Change Ventilation to on Replace fan
Stage 1/Stage 2 fan(s) run full speed	Wiring incorrect Minimum ventilation settings too high (Parameters 2/3) Stage 1/Stage 2 P-Band set to 0 (Parameters 6/9) Room temperature above Temperature Set (Parameter 1)	Correct wiring Decrease minimum ventilation settings Increase Stage 1/Stage 2 P-Band Adjust Temperature Set to desired temperature
Stage 1/Stage 2 fan(s) run erratically	P.F. Compensation is not set correctly	Adjust P.F. Compensation (Parameters 24/25)

Problem	Cause	Solution
Stages 3, 4 or 5 Relay(s) not operating loads	Wiring incorrect Display board inter-connect cable is not plugged into the power supply board properly Turn-On settings for stages incorrect (Parameters 10/11/12) Wrong Setup parameters selected (Parameters 26/27/28) Ventilation is turned off (V off) (Parameter 24) Note: This is only applicable to stages in cooling mode Fan/Heater is faulty	Correct wiring Be sure the inter-connect cable is firmly plugged in Adjust Turn-On settings Correct Setup Parameters settings Change Ventilation to on Replace Fan/Heater
Alarm relay not operating alarm system	Wiring incorrect	Correct wiring
Alarm message on display	Alarm condition present	See Alarm section. Clear alarm condition by pressing RETURN
Inlet is not operating	Control wiring incorrect Inlet actuator power supply wiring incorrect Inlet actuator power supply 4 Amp slow-blow fuse(s) open Display board inter-connect cable is not plugged into the power supply board properly The inlet is in manual operation mode Inlet Position Parameter(s) set too low or at 0 (Parameters 14,15,16,17 & 18)	Correct wiring Correct wiring Replace fuse(s) Be sure the inter-connect cable is firmly plugged in Change Inlet Manual Operation (parameter 37) to OFF Adjust the Inlet Parameters to the desired values
Inlet does not calibrate	The RETURN button was pressed during calibration The feedback wires are reversed	Pressing RETURN during calibration will stop the calibration process Reverse the MAX (+) and MIN (-) wires
Inlet Alarm message on display	Alarm condition present	See the Alarm Messages section for an explanation of the alarms. Clear the alarm by pressing RETURN

Problem	Cause	Solution
Inlet Actuator Motor is starting and stopping while the inlet is to be at a fixed position	Inlet Hysteresis is set to low or at 0 (parameter 38)	Increase value of Inlet Hysteresis (parameter 38)
Inlet appears to open/close normally, however a Jam Alarm appears	Inlet Time Out interval is too short (parameter 39)	Increase Inlet Time Out interval (parameter 39)

If you cannot determine the solution to your problem contact your dealer or Phason Technical Support for assistance.

Appendix D: blank program tables

- ◆ Blank parameter chart on page 58
- ◆ Blank setup parameter chart on page 59

Blank parameter chart

When changes to the programs are made the changes should be marked in the tables below. This will provide a quick reference chart to refer to when reprogramming the PEC in the future.

#	Parameters	Program names			
		<i>R</i>	<i>b</i>	<i>c</i>	<i>d</i>
	Main				
1	Temp Set (Start P-Band1)				
2	Stage 1 Min Vent				
3	Stage 2 Min Vent				
4	Inlet Min				
	Differential				
5	Stage 1 Off-Set-Back				
6	Stage 1 P-Band1				
7	Stage 2 Off-Set-Back				
8	Stage 2 Start P-Band2				
9	Stage 2 P-Band2				
10	Stage 3 Turn On				
11	Stage 4 Turn On				
12	Stage 5 Turn On				
	Inlet				
13	Inlet Close-Set-Back				
14	Position P-Band 1				
15	Position P-Band 2				
16	Position Stage 3				
17	Position Stage 4				
18	Position Stage 5				
	Alarms				
19	Low Temp Alarm				
20	High Temp Alarm				
	General (common to all programs)				
21	Low Power Alarm				
22	Inlet Alarms				
23	Alarm Latching				
24	Ventilation				

Blank setup parameter chart

#	Setup (hidden) parameters common to all programs	Setting
25	Temperature Units	
26	Stage 3 Operation	
27	Stage 4 Operation	
28	Stage 5 Operation	
29	Stage 5 Proportional	
30	Stage 5 Interval	
31	Stage 5 P-Band	
32	Stage 1 Minimum Idle	
33	Stage 2 Minimum Idle	
34	Hysteresis	
35	Stage 1 P.F. Compensation	
36	Stage 2 P.F. Compensation	
37	Inlet Manual Operation	
38	Inlet Hysteresis	
39	Inlet Time Out	
40	Inlet Calibration	

Phason Inc.
2 Terracon Place
Winnipeg, Manitoba, Canada
R2J 4G7

Phone: 204-233-1400
Fax: 204-233-3252

E-mail: support@phason.ca
Web site: www.phason.ca